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THE GEOLOGICAL SURVEY OF INDIA

VOL. LIV, PART 2.

1922

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RECORDS

OF

THE GEOLOGICAL SURVEY OF INDIA.

Part 2.] 1922 [September.

THE MINERAL PRODUCTION OF INDIA DURING 1921.

BY L. LEIGH FERMOR, O.B.E., D.Sc., A.R.S.M., F.G.S., M.I.M.M., *Officiating Director, Geological Survey of India.*

CONTENTS.

INTRODUCTION.

THE method of classification adopted in the first Review of Mineral Production published in these Records (Vol. XXXII), although admittedly not entirely satisfactory, is still the best that can be devised under present conditions. As the methods of collecting the returns become more precise and the machinery employed

for the purpose more efficient, the number of minerals included in class I—for which approximately trustworthy annual returns are available—increases, and it is hoped that before long the minerals of class II—for which regularly recurring and full particulars cannot be procured—will be reduced to a very small number. In the case of minerals still exploited chiefly by primitive native methods, and thus forming the basis of an industry carried on by a large number of persons each working independently and on a very small scale, the collection of reliable statistics is impossible, but the total error from year to year is not improbably approximately constant and the figures obtained may be accepted as a fairly reliable index to the general trend of the industry. In the case of gold, the small indigenous alluvial industry contributes such an insignificant portion to the total outturn that any error from this source may be regarded as negligible.

In the previous Review the statement of values of the Indian Mineral Production for the year under review and for the preceding year was drawn up for purposes of comparison on the basis of an exchange value of the rupee at 2*s.* in each year, although this figure applied in practice only to the year 1920. With the great fall of the value of the rupee during 1921, it has become impossible to maintain this method of comparison, and the values shown in table 1 of the present Review are given on the basis of the actual average exchange values of the rupee for each year. For the sake of completeness, the values of the mineral production for 1919 have also been recalculated on the basis of the actual value of the rupee for that year. In the year 1919, the highest value reached was 2*s.* $4\frac{7}{8}$*d.*, and the lowest 1*s.* $5\frac{3}{32}$*d.*, the actual average value of the rupee during the year being 1*s.* $8\frac{29}{32}$*d.*; for purposes of calculation, a value of 1*s.* $8\frac{7}{8}$*d.*, corresponding to Rs. 11·5 to the £, has been adopted. In 1920, the highest value reached was 2*s.* $10\frac{1}{2}$*d.*, and the lowest value 1*s.* $4\frac{3}{4}$*d.*, the actual average value during the year being 2*s.* $0\frac{1}{16}$*d.*; the value of 2*s.* has been adopted in the table. In 1921, the highest value reached was 1*s.* $6\frac{1}{8}$*d.* and the lowest 1*s.* $2\frac{7}{8}$*d.*, the actual average value of the rupee during the year being 1*s.* $4\frac{1}{32}$*d.*, and the value of 1*s.* 4*d.* has been adopted. With these rates of exchange the total production of 1921 shows a decrease in value compared with 1920 of £8,232,930 or 27·3 per cent. as contrasted with an increase in 1920 compared with 1919 of £5,282,130 or 21·3 per cent. Decreases in value during 1921 were

shown by all the metals and minerals produced, with the exception of iron-ore and a few unimportant minor mineral products. The largest percentage decreases amongst important minerals are shown by wolfram, mica, tin, manganese, chromite, and salt. These changes in value are, of course, an expression in part of the great variation in the prices of metals and ores in the world's markets, due first to the boom that followed immediately on the cessation of the war, and then to the succeeding and still existing period of depression, and in part of variations in the quantities produced, due partly to the variations in market price. It is interesting to compare in the figures of total value recorded in table 1 with the variations in the average annual value of the leading metals in the world's markets as summarised in table 2.

The number of mineral concessions granted during the year amounted to 651 as against 652 in the preceding year; of these 4 were exploring licenses, 563 were prospecting licenses, and 84 were mining leases.

TABLE 1.—*Total Value of Minerals for which returns of Production are available for the years 1919, 1920 and 1921.*

——	1919. (Rupee =1*s.* 8¾*d.*)	1920. (Rupee =2*s.*)	1921. (Rupee =1*s.* 4*d.*)	Increase.	Decrease.	Variation. Per cent.
	£	£	£	£	£	
Coal . . .	8,799,353	9,297,853	8,673,377	...	624,476	—7·2
Petroleum . .	7,252,951	7,954,632	5,603,975	...	2,350,657	—29·6
Gold . . .	2,127,708	2,733,115	2,050,576	...	682,539	—25·0
Manganese-ore(*a*) .	1,344,634	3,586,072	1,537,068	...	2,049,004	—57·1
Lead and lead-ore .	581,427	975,927	784,586	...	191,341	—19·6
Salt . . .	1,585,671	1,446,409	742,147	...	704,262	—48·7
Silver . . .	409,780	843,109	593,008	...	250,101	—29·7
Mica(*a*) . .	750,824	1,065,438	426,274	...	639,164	—60·0
Building materials	379,289	454,750	422,219	...	32,531	—7·1
Saltpetre . .	409,780	590,854	357,032	...	233,822	—39·6
Tin and tin-ore .	218,904	325,626	162,770	...	162,856	—59·4
Iron-ore . .	39,902	118,163	140,555	22,392	...	+18·9
Carried over .	23,900,223	29,391,948	21,493,587	22,392	7,920,753	..

(*a*) Export values.

TABLE 1,—*Total Value of Minerals for which returns of Production are available for the years 1919, 1920 and 1921*—contd.

—	1919 (Rupee = 1*s.* 8$\frac{7}{8}$*d.*)	1920 (Rupee = 2*s.*)	1921 (Rupee = 1*s.* 4*d.*)	Increase.	Decrease.	Variation per cent.
	£	£	£	£	£	
Brought forward .	23,900,223	29,391,948	21,493,587	22,392	7,920,753	...
Jadeite(*a*) . .	75,742	180,728	126,535	...	54,193	—29·9
Ruby, sapphire and spinel.	93,989	61,982	50,165	...	11,817	—19·1
Clays . . .	43,451	40,812	37,378	...	3,434	—8·4
Chromite . .	77,151	79,970	36,492	...	43,478	—54·3
Copper-ore . .	45,579	42,250	32,560	...	9,690	—22·9
Monazite . .	52,793	49,231	30,959	...	18,272	—37·1
Tungsten-ore .	453,212	139,707	29,292	...	110,415	—79·0
Magnesite . .	17,155	17,216	15,632	...	1,584	—9·2
Steatite . .	5,650	10,585	5,880	...	4,705	—44·4
Diamonds . .	18,109	4,125	4,865	740	...	+17·9
Alum . .	4,174	7,320	4,293	...	3,027	—41·3
Barytes . .	1,357	1,553	3,485	1,932	...	+124·4
Bauxite . .	1,682	5,331	3,280	...	2,051	—38·5
Gypsum . .	2,494	3,693	2,267	...	1,426	—38·6
Ochre . . .	3,130	5,356	2,174	...	3,182	—59·4
Aquamarine and beryl	...	1,225	1,274	49	...	+4·0
Amber . .	536	1,666	1,123	...	543	—32·6
Fuller's earth .	...	...	966	966	...	...
Asbestos . .	1,440	7,272	884	...	6,388	—87·8
Apatite . .	...	...	231	231	...	...
Antimony-ore .	177	40	70	30	...	+75·0
Corundum . .	4,649	575	55	...	520	—81·7
Graphite . .	713	560	52	...	508	—90·7
Soda . . .	...	...	24	24	...	...
Molybdenite .	88	19	13	...	6	—31·6
Potash. . .	37	25	...	...	25	...
Samarskite . .	9	12	...	...	12	...
Total .	24,803,540	30,053,201	21,883,536	26,364	8,196,029	27·3
				—8,169,665		

(*a*) Export values.

TABLE 2.—*Average Prices in the United Kingdom of Principal Metals and Ores during 1919, 1920 and 1921.**

—	1919.	1920.	1921.
	£ per ton.	£ per ton.	£ per ton.
Metals—			
Copper, standard	92·29	99·78	69·69
Lead, pig, soft foreign	27·96	39·31	22·69
Spelter, ordinary	42·41	46·61	26·06
Tin, standard	253·17	299·9	166·02
Pig-iron, Cleveland foundry No. 3	6·84	10·53	6·89
Steel, heavy rails	(*a*)	23·04	15·62
Ferro-manganese	25·5	34·58	20·37
Gold, fine, per ounce	84·954 *sh.* (*b*)	112·960*sh*	107·041*sh.*
Silver, standard, per ounce	57·709*d.*	61·590*d.*	36·80*d.*
Ores—			
Chromite, 48-51%, per ton	£9·4	£8·7	£4·59
Manganese-ore, first grade, per unit	30*d.*	45*d.*	17*d.*
Wolfram, per unit	33·4*sh.*	28·52*sh.*	13·96*sh.*

* Compiled mainly from the *Mining Journal* and the *Iron and Coal Trades Review*.
(*a*) Not available.
(*b*) Royal Mint price.

II.—MINERALS OF GROUP I.

Chromite.	Gold.	Lead.	Monazite.	Salt.
Coal.	Graphite.	Magnesite.	Petroleum.	Saltpetre.
Copper.	Iron.	Manganese.	Ruby, Sapphire and Spinel.	Silver.
Diamonds.	Jadeite.	Mica.		Tin.
				Tungsten.

Chromite.

The continued decrease in the output of chromite during the years 1919 and 1920 from the peak production of 1918 was not continued in 1921, when there was an increase in output of nearly 8,000 tons over the previous year, the output for Baluchistan being the maximum on record.

TABLE 3.—*Quantity and Value of Chromite produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value. (Rupee=2*s.*)		Quantity.	Value. (Rupee=1*s.* 4*d.*)	
	Tons.	Rs.	£	Tons.	Rs.	£
Baluchistan—						
Zhob . .	20,577	6,68,744	66,875	25,122	3,76,826	25,122
Bihar & Orissa—						
Singhbhum .	2,546	57,394	5,739	2,605	52,610	3,507
Mysore—						
Hassan . .	3,400	68,000	6,800	6,486	116,748	7,783
Mysore . .	278	5,560	556	549	1,198	80
Total .	**26,801**	*7,99,698*	*79,970*	**34,762**	*547,382*	*36,492*

Coal.

In contrast to public expectation, there was an increase during the year of over 1,300,000 tons, or somewhat over 7 per cent., in the output of coal. This increase was due largely to Bihar and Orissa and the Central Provinces, but all the other provinces show increases, with the exception of Assam and Hyderabad, which show small decreases. The considerable increase shown by Bihar and Orissa was due chiefly to the Jharia and Bokaro fields, whilst the increase in the Central Provinces was due mainly to the Pench Valley and Ballarpur fields. In Hyderabad State the Singareni field showed a decrease of about 48,000 tons, which was nearly balanced by an initial production of over 42,000 tons from the Sasti coalfield opposite to Ballarpur in British territory. There was a general increase in the pit's mouth value of coal, except in Baluchistan, the rate of increase varying from as little as Re. 0-5-7 in Assam to Rs. 2-9-10 in the Punjab ; the increase in the fields of Bihar and Orissa averaged Re. 1-13-8 and in Bengal Re. 1-6-3. The decrease in Baluchistan was Rs. 2-8-1 per ton. During the year, the existence was proved in the Talcher coalfield of considerable quantities of good steam coal, and this field is now in course of commercial development.

TABLE 4.—*Average Price (per ton) of Coal extracted from the Mines in each province during the year 1920 and 1921.*

——	1920.	1921.
	Rs. A. P.	Rs. A. P.
Assam	7 7 9	7 13 4
Baluchistan	16 9 9	14 1 8
Bengal	6 5 5	7 11 8
Bihar and Orissa	4 9 2	6 6 10
Burma	...	11 7 6
Central India	4 4 10	5 11 6
Central Provinces	5 13 3	7 0 0
Punjab	12 3 10	14 13 8
Rajputana	7 7 1	8 13 4

TABLE 5.—*Origin of Indian Coal raised during 1920 and 1921.*

——	Average of last five years.	1920.	1921.
	Tons.	Tons.	Tons.
Gondwana coalfields	18,953,226	17,526,444	18,843,792
Tertiary coalfields	402,769	435,770	459,155
Total	**19,355,995**	**17,962,2 4**	**19,302,947**

TABLE 6.—*Provincial Production of Coal during the years 1920 and 1921.*

Province.	1920.	1921.	Increase.	Decrease.
	Tons.	Tons.	Tons.	Tons.
Assam	325,535	312,465	...	13,070
Baluchistan	33,941	54,627	20,686	...
Bengal	4,207,452	4,259,642	52,190	...
Bihar and Orissa	11,975,656	12,990,481	1,014,825	...
Burma	...	300	300	...
Central India	158,051	192,034	33,983	...
Central Provinces	491,205	712,914	221,709	...
Hyderabad	694,080	688,721	...	5,359
Punjab	58,078	67,242	9,164	...
Rajputana	18,216	24,521	6,305	...
Total	**17,962,214**	**19,302,947**	*1,359,162*	*18,429*

TABLE 7.—*Output of the Gondwana Coalfields for the years 1920 and 1921.*

Coalfield.	1920.		1921.	
	Tons.	Per cent. of Indian Total.	Tons.	Per cent. of Indian Total.
Bengal, Bihar and Orissa—				
Bokaro	857,522	4·78	929,143	4·81
Daltonganj	39,113	0·22	36,590	0·19
Giridih	831,293	4·63	818,580	4·24
Jainti	118,651	0·66	105,652	0·55
Jharia	9,294,040	51·74	10,068,856	52·16
Rajmahal Hills	960	...	2,170	0·01
Ramgarh	6,863	0·04	...	...
Rampur (Raigarh-Hingir)	36,987	0·21	77,277	0·40
Raniganj	4,997,670	27·82	5,211,855	27·00
Central India—				
Sohagpur	...	...	37,060	0·19
Umaria	158,051	0·88	154,974	0·80
Central Provinces—				
Ballarpur	128,162	0·71	171,425	0·89
Mohpani	83,335	0·47	89,623	0·47
Pench Valley	279,483	1·56	449,311	2·33
Shahpur	...	...	210	...
Yeotmal	225	...	2,345	0·01
Hyderabad—				
Sasti	27,745	...	42,674	0·22
Singareni	660,335	3·86	646,047	3·35
Total	17,526,444	97·58	18,843,792	97·62

TABLE 8.—*Output of the Tertiary Coal-fields for the years 1920 and 1921.*

Coalfield.	1920.		1921.	
	Tons.	Per cent. of Indian Total.	Tons.	Per cent. of Indian Total.
Assam—				
Khasi and Jaintia Hills	570	1·81	443	1·62
Makum	285,974		269,198	
Naga Hills	38,991		42,824	
Baluchistan—				
Kalat, Mach, Sor Range	11,406	0·10	23,374	0·28
Khost	22,535		31,253	
Burma—				
Loi-an (Kalaw)	...	...	300	...
Punjab—				
Jhelum	47,803	0·32	50,039	0·35
Mianwali	6,835		11,852	
Shahpur	3,440		4,751	
Rajputana—				
Bikanir	18,216	0·10	24,521	0·13
Total	**435,770**	2·42	**459,155**	2·38

In spite of the considerable increase, the total production was nevertheless nearly 3 million tons below the output of 1919, and the coal situation became so acute that it was found necessary early in the year to prohibit the export of Indian coal to foreign ports. The effects of this step are seen in the export statistics, which show a fall from a total of nearly 1¼ million tons in 1920 to slightly over ¼ million tons in 1921. On the other hand, the imports rose from the insignificant figure of under 40,000 tons in 1920 to over 1 million tons in 1921, 462,000 tons coming from South Africa, 436,000 tons from the United Kingdom, 111,000 from Australia (including New Zealand), and the balance from other countries.

TABLE 9.—*Exports of Indian Coal and Coke during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value	
	Tons.	Rs.	£	Tons.	Rs.	£
To—						
Aden and Dependencies	83,668	10,81,370	108,137	17,575	2,01,166	13,411
Ceylon	684,930	86,87,960	868,796	236,179	32,01,578	213,439
Straits Settlements (including Labuan)	228,108	29,79,060	297,906	10,682	1,52,100	10,140
Sumatra	69,473	8,38,060	83,806	6,251	87,514	5,834
Egypt	102,457	13,41,870	134,187	200	400	27
Other Countries	53,981	7,23,210	72,321	2,761	1,11,119	7,408
TOTAL	1,222,517	1,56,51,530	1,565,153	273,648	37,53,877	250,259
Coke	2,241	61,510	6,151	1,923	93,518	6,234
Total of Coal, Coke, etc.	**1,224,758**	*1,57,13,040*	*1,571,304*	276,571	*38,47,395*	*256,493*

TABLE 10.—*Imports of Coal, Coke and Patent Fuel during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
From—						
Australia (including New Zealand).	8,134	2,01,380	20,138	111,384	37,58,254	250,350
Natal	7,596	2,30,940	23,094	306,235	1,13,16,644	754,443
Portuguese East Africa	7,933	2,37,110	23,711	156,555	58,74,560	391,637
United Kingdom	4,122	2,08,600	20,860	436,012	1,86,17,067	1,241,138
Other Countries	10,801	3,04,180	30,418	74,501	25,57,310	170,487
TOTAL	38,586	11,82,210	118,221	1,084,687	4,21,23,835	2,808,255
Coke	1,141	1,10,800	11,080	6,051	5,01,311	33,421
Patent fuel	..	..	..	11	2,502	167
Total of Coal, Coke, etc.	39,727	*12,93,010*	*129,301*	1,090,749	*4,26,27,648*	*2,841,843*

This decrease in the production of coal in India, in the years 1920 and 1921, as compared with 1919, is probably to be correlated to a large extent with the decreased efficiency of labour, following at least in part on increases in wages, which enabled the worker to obtain his requirements in a smaller number of working hours per day; and to a smaller extent to the increased price of coal, which resulted in an increase in the number of shallow workings, to which labour was attracted from the better organised mines. A higher output per head is probably to be obtained in the future only by the greater use of mechanical means of cutting, extraction, and

transport. Any large increase of output in the near future will not, however, relieve the situation in full, until the railways have provided themselves with increased terminal facilities and doubled or trebled some of the existing lines.

The average number of persons employed daily in the coalfields during the year increased by 15,537 or about 8 per cent., the total number of persons employed exceeding even the total for the year 1919; but the average output per person employed was less even than that of the preceding year, being 93·98 tons per person as against 94·37 tons in 1920 and 111·05 tons in 1919. The total number of deaths by accident was 286, corresponding to a death-rate of 1·39 per thousand persons employed, which compares very unfavourably with 189 deaths by accident and a death-rate of 0·99 per thousand in 1920; the 1921 figures are, however, very similar to those of 1919, which were 287 deaths or 1·41 per thousand persons employed.

TABLE 11.—*Average number of persons employed daily in the Indian Coalfields during 1920 and 1921.*

Province.	Number of persons employed daily.		Output per person employed.	Number of deaths by accident.	Death-rate per 1,000 persons employed.
	1920.	1921.	1921.	1921.	1921.
			Tons.		
Assam	3,171	3,389	92·2	16	4·7
Baluchistan	986	1,330	41·1	9	6·7
Bengal	43,782	45,813	93·0	48	1·05
Bihar and Orissa	118,260	126,431	102·7	163	1·3
Burma	242	270	1·1	1	3·7
Central India	1,617	1,967	97·6	8	4·0
Central Provinces	8,403	12,152	58·6	18	1·5
Hyderabad	12,446	12,502	55·1	21	1·7
Punjab	1,320	1,898	35·4	2	1·05
Rajputana	115	127	193·1	...	...
Total	**190,342**	**205,879**	...	286	...
AVERAGE	...	...	93·76	...	1·39

Copper.

The output of copper-ore in Singhbhum has been maintained at a fairly steady level since 1919, following the commencement of

smelting operations at the Rakha Mines during the year 1918. The output in 1919 was 32,756 tons, which fell in 1920 to 28,167 tons, valued at £42,250, and again in 1921 to 23,089 tons, valued at £32,560. Smelting operations, commenced during the year 1918, resulted in the production of 980¼ tons of refined copper in the year 1919, 512 tons in 1920, and 1,143 tons in 1921. There was also a small production of 30 tons of copper-ore in Mysore State.

Diamonds.

The output of diamonds from Central India amounted to 126·1 carats, valued at Rs. 72,970 (£4,865), as against 85·1 carats, valued at Rs. 41,252 (£4,125) in the preceding year.

Gold.

The continuous decrease in the output of gold in India from the maximum production of 616,728 ozs. reached in 1915, continued during the year 1921, when the total output of gold was 432,723 ozs., valued at £2,050,576, as compared with an output of 499,068 ozs., valued at £2,733,115 in the previous year. This decrease was due partly to the cessation of operations of the Hatti (Nizam's) Gold Mines, Limited, and to a decrease of some 50,000 ozs. from the gold mines of Kolar.

TABLE 12.—*Quantity and value of Gold produced in India during 1920 and 1921.*

	1920.			1921.			Labour.
	Quantity.	Value.		Quantity.	Value.		
	Ozs.	Rs.	£	Ozs.	Rs.	£	
Burma—							
Katha	3·04	202	20	15·66	927	62	112
Upper Chindwin.	7·69	717	72	26·503	3,115	208	
Hyderabad	12,390	5,88,695	58,869·5				
Madras—							
Anantapur	13,615	8,03,535	80,353·5	10,108 (*a*)	7,21,359	48,091	535
Mysore	472,958	2,59,33,544	2,593,354	422,533(*b*)	3,00,30,373	2,002,025	23,344
Punjab	61·18	4,274	427	39·43	2,853	190	45
United Provinces	2·7	199	19	*Nil.*	*Nil.*	..	*Nil.*
Total	499,067·61	*2,73,31,158*	*2,733,115*	432,722·593	*3,07,55,627*	*2,050,576*	24.045

(*a*) Fine gold.
(*b*) Contains 380,780·40 ozs. fine gold.

Graphite.

There was a fall in the output of graphite from 100 tons, valued at Rs. 5,600 (£560) in 1920, to 25 tons, valued at Rs. 784 (£52) in the year under review. This decrease in output was due largely to the discontinuance of operations in Patna State and Ajmer-Merwara.

TABLE 13.—*Quantity and value of Graphite produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
Bihar and Orissa—	Tons.	Rs.	£	Tons.	Rs.	£
Bhagalpur .	...	...	...	1	60	4
Patna . .	60	3,600	360	*Nil*	..	..
Singhbhum .	0·2	15	1·5	*Nil*	..	..
Central Provinces—						
Betul . .	23·1	540	54	24·1	724	48
Rajputana—						
Ajmer-Merwara	16·8	1,445	144·5	*Nil*	...	...
Total .	100·1	*5,600*	*560*	25·1	*784*	*52*

Iron.

There was an increase in the output of iron-ore of about 70 per cent., *viz.*, from 558,005 tons, valued at Rs. 11,81,628 (£118,163) to 942,084 tons, valued at Rs. 21,08,329 (£140,555). This increased production was due largely to the increased activity of the Tata Iron and Steel Company, Limited, who blew in their third blast furnace (the Batelle furnace) in August 1919, the full effect of which was not felt until 1921, when the company produced 281,541 tons of pig iron, 125,336 tons of steel including rails, and 3,076 tons of ferro-manganese. The Bengal Iron Company record a slightly smaller output than in the preceding year, *viz.*, 86,445 tons of pig iron and 27,219 tons of cast iron castings, with no production of ferro-manganese. The remainder of the increased production of iron-ore is due largely to extraction by the Indian Iron and Steel Company in anticipation of the commencement of smelting operations at Burnpore. In the Central Provinces, the number of

indigenous furnaces in operation fell from 225 in 1920 to 155 in 1921, the decrease being mainly in the Raipur district. The output in Burma is by the Burma Corporation, Limited, for use as a flux in lead-smelting.

TABLE 14.—*Quantity and value of Iron-ore produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Bihar and Orissa—						
Mayurbhanj . .	403,359	8,06,718(*a*)	80,672	651,495	13,02,990(*a*)	86,866
Sambalpur . . .	1,010	5,722	572	797	4,602	307
Singhbhum . . .	113,008	2,08,641	20,864	237,173	5,88,774	39,251
Burma—						
Mandalay . . .	19,104	77,716	7,772	11,916	47,664(*a*)	3,178
Northern Shan States .	18,279	72,045	7,204	37,915	1,51,660(*a*)	10,110
Central Provinces . .	3,241	10,786	1,079	2,433	9,925	662
Other Provinces and States	4	(*b*)	..	355	2,714	181
TOTAL .	558,005	*11,81,628*	*118,163*	942,084	*21,08,329*	*140,555*

(*a*) Estimated. (*b*) Not available.

Jadeite.

There was a small increase in the output of jadeite in Burma, which rose from 3,429 cwts., valued at Rs. 4,83,514 (£48,351) in 1920, to 3,815 cwts., valued at Rs. 7,01,673 (£46,778) in the year under review. The output figures are, however, always incomplete, and a better idea of the extent of the jadeite industry is obtainable from the export figures, which for the year 1920-21 were 5,094 cwts., valued at Rs. 18,07,284 (£180,728), increasing in the year under review to 5,374 cwts., valued at Rs. 18,98,030 (£126,535)

Lead.

The production of lead-ore at the Bawdwin mines increased by some 15,000 tons; and the total amount of metal extracted increased from 23,821 tons, valued at Rs. 97,56,213 (£975,621), to 33,717 tons, valued at Rs. 1,17,46,967 (£783,131). The quantity of silver extracted rose from 2,869,727 ozs., valued at Rs. 83,37,362 (£833,736), to 3,555,021 ozs., valued at Rs. 88,20,855 (£588,057). The value of the lead extracted decreased from Rs. 409 (£40·9) per ton in 1920 to Rs. 348 (£23·2) per ton in the year under review, and that of silver from Rs. 2-14-0 per oz. (69*d.*) to Rs. 2-7-8 (39·7*d.*) per oz.

TABLE 15.—*Production of Lead and Silver Ore during 1920 and 1921.*

	1920.					1921.				
	QUANTITY.	VALUE.				QUANTITY.	VALUE.			
	Lead-ore.	Lead-ore and lead.		Silver.		Lead-ore.	Lead-ore and lead.		Silver.	
	Tons.	Rs.	£	Rs.	£	Tons.	Rs.	£	Rs.	£
Burma—										
Northern Shan States.	123,908 (ore)	97,56,213(*a*)	975,621	83,37,362(*b*)	833,736	144,089	1,17,46,967(*c*)	783,131	88,20,855(*d*)	588,057
Southern Shan States	88·25	2,708	271	..	..	138·1	21,812	1,454	..	..
Central Provinces—										
Drug . . .	0·05	350	35	..	..	0·5	10	1	..	..
Total .	128,996·30	*97,59,271*	*975,927*	*83,37,362*	*833,736*	144,227·6	*1,17,68,789*	*784,586*	*88,20,855*	*588,057*

(*a*) Value of 23,821 tons of lead extracted.
(*b*) Value of 2,869,727 ozs. of silver extracted.
(*c*) Value of 33,717 tons of lead extracted.
(*d*) Value of 3,555,021 ozs. of silver extracted.

Magnesize.

The check on the revival of the Indian magnesite industry recorded last year disappeared during 1921, when the output increased by nearly 6,000 tons over the figure for the preceding year, reached the highest figure that has yet been recorded.

TABLE 16.—*Quantity and value of Magnesite produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Madras—						
Salem . .	11,300	1,35,600	13,560	17,152	205,824	13,722
Mysore—						
Hassan .	640·5	7,686	769	50	500	33
Mysore . .	2,406	28,872	2,887	2,815	28,150	1,877
Total .	**14,346·5**	*1,72,158*	*17,216*	**20,017**	*2,34,474*	*15,632*

Manganese.

In the year 1920 the output of manganese-ore in India reached a figure, 736,439 tons, which has previously been exceeded only twice, *viz.*, in the year 1907, when the output was 902,291 tons, and in 1910 with 800,907 tons. In value, however, the output for 1920 reached by far the highest figure hitherto recorded, *viz.*, £3,586,072, this being the f. o. b. value at Indian ports of the total production, calculated from the average c. i. f. value at United Kingdom ports and the average freight rates from India to the United Kingdom, taken respectively at 45*d.* per unit and £4 9*s.* 4*d.* per ton. During 1921, there was a small fall in output to 679,286 tons, valued at £1,537,068 f. o. b. at Indian ports, calculated from an average c. i. f. value at United Kingdom ports of 17*d.* and an average freight rate from India to United Kingdom ports at £1 5*s.* From tables 17 and 18 it will be seen, however, that the exports during the year were about 130,000 tons less than the production, as compared with 1920, when the exports corresponded almost

exactly with the production. The figures of distribution of the exported ore according to destination show that this decrease in exports was due chiefly to the enormous decrease of over a quarter of a million tons in the quantity of ore taken by the United Kingdom, due, of course, to the disastrous reduction in steel-smelting in Britain due to the effects of the coal strike and high labour charges. The large exports to Belgium are in part for transmission to Germany.

TABLE 17.—*Quantity and value of Manganese-ore produced in India during 1920 and 1921.*

	1920.		1921.	
	Quantity.	Value f. o. b. at Indian ports.	Quantity.	Value f. o. b. at Indian ports.
	Tons.	£	Tons.	£
Bihar and Orissa—				
Gangpur	21,161	103,865	19,823	45,427
Singhbhum	500	2,454	425	974
Bombay—				
Chota Udepur	29,230	143,471	29,467	67,528
Panch Mahals	34,166	167,698	44,276	101,465
Central Provinces—				
Balaghat	257,857	1,262,026	253,599	581,160
Bhandara	90,949	446,469	69,291	158,790
Chhindwara	51,517	252,896	43,661	100,055
Nagpur	221,912	1,089,366	186,491	427,372
Madras—				
Sandur State	...	...	567	921
Vizagapatam	7,386	27,882	16,593	26,964
Mysore—				
Chitaldrug	...	...	1,000	1,750
Shimoga	21,667	89,556	13,493	23,612
Tumkur	94	389	600	1,050
Total	**736,439**	*3,586,072*	**679,286**	*1,537,068*

TABLE 18.—*Exports of Manganese-ore during 1920 and 1921 according to ports of shipment.*

Port.	1920.	1921.
	Tons.	Tons.
Bombay	377,148	271,826
Calcutta	323,258	259,621
Vizagapatam	10,450	8,442
Mormugao	25,745	10,874
Total	736,601	550,763

TABLE 19.—*Distribution of Manganese-ore exported during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
To—	Tons.	Rs.	£	Tons.	Rs.	£
United Kingdom	350,383	68,73,700	687,370	96,750	24,05,018	160,305
Belgium	164,832	37,92,760	379,276	228,764	55,71,260	371,418
France	70,091	15,59,040	155,904	79,855	17,05,707	110,714
Italy	15,300	3,83,120	38,312	9,600	3,07,300	20,487
Japan	...	...	...	2,250	58,225	3,882
United States of America	105,600	25,01,150	250,115	86,360	23,28,925	155,262
Other Countries	4,650	1,25,390	12,539	30,301	9,04,660	60,311
Total	710,856	*1,53,30,160*	*1,533,016*	539,889	*1,33,72,004*	*891,469*

Mica.

The declared output of mica shows a large decrease, amounting to over 14,000 cwts., from that of the previous year. As has frequently been pointed out, the output figures are incomplete, and a better idea of the state of the industry is obtained from the export figures, which show a fall from 76,517 cwts., valued at Rs. 1,06,54,380 (£1,065,438) in 1920 to 30,914 cwts., valued at Rs. 63,94,113 (£426,274) in 1921, corresponding to a change in the average price from Rs. 139 (£13·9) per cwt. to Rs. 206·6 (£13·8) per cwt.

TABLE 20.—*Quantity and value of Mica produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Cwts.	Rs.	£	Cwts.	Rs.	£
Bihar and Orissa—						
Gaya	4,822	1,00,864	19,086	5,013	1,77,473	11,832
Hazaribagh	26,984	13,93,200	139,321	20,746	10,82,535	72,169
Manbhum	0·5	102	10	4	60	4
Monghyr	1,069	44,232	4,423	291	7,597	506
Sambalpur	8	300	30	4	150	10
Central Provinces	0·3	12	1	..	..	..
Madras—						
Kistna	83	2,701	270	8	499	33
Nellore	11,160·8	5,60,979	56,098	4,207	2,05,140	13,677
Nilgiris	..	..	..	14	1,696	113
Salem	509	46,203	4,620	20	1,595	106
Travancore	175	4,531	453	37	1,506	100
Mysore—						
Hassan	..	..	..	113	4,120	275
Mysore	55·2	2,125	213	69	153	10
Rajputana—						
Ajmer-Merwara	2,085·7	1,05,517	10,552	1,872	111,033	7,402
Total	46,952·5	*23,50,775*	*235,077*	32,488	*15,93,566*	*106,377*

Monazite.

There was a further decrease in the output of monazite in Travancore, which fell from 1,641 tons, valued at £49,231 in 1920 to 1,260 tons, valued at £30,959 in the year under review.

Petroleum.

In the previous Review it was necessary to record a decrease of 12½ million gallons in the output of petroleum from the production of 305,749,138 gallons recorded for the year 1919. In the year 1921 the total production almost equalled that of 1919, amounting to 305,683,227 gallons, important increases being recorded for the Singu and Yenangyaung fields, partly balanced by a large decrease at Badarpur, and small decreases at every other field, except the Akyab and Upper Chhindwin fields in Burma, and the Mianwali and Attock fields in the Punjáb. Owing, however, to the fall in the exchange value of the rupee, the value of the production has fallen from £7,954,632 in 1920 to £5,603,974 in 1921.

During the year active prospecting was conducted in the Punjab, Sind, Assam, and Burma, by a variety of oil interests and several

important concessions were demarcated. The only case, however, that has come to notice of the actual proof by drilling of the existence of oil in an area not hitherto producing is the Padaukpin area in Thayetmyo, from which the Indo-Burma Oilfields, Limited, are now obtaining a small production. In the Punjab the oil industry has entered on a new phase with the completion at Rawalpindi, and the opening in February 1922, of the refinery erected by the Indo-Burma Petroleum Co. to deal with the production of the Khaur oilfield in the Attock district. The refinery has a daily capacity of 65,000 gallons of crude oil.

TABLE 21.—*Quantity and value of Petroleum produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Gals.	Rs.	£	Gals.	Rs.	£
Assam—						
Digboi	5,206,850	2,57,630	25,763	5,060,461	2,50,333	16,722
Badarpur	8,151,322	6,11,349	661,135	4,461,473	3,34,611	22,308
Burma—						
Akyab	9,770	2,747	275	9,780	2,821	188
Kyaukpyu	30,075	8,459	846	27,869	19,124	1,275
Minbu	3,835,198	10,78,649	107,865	3,706,831	11,58,385	77,226
Singu	95,256,753	2,67,90,962	2,679,096	104,167,749	2,92,97,179	1,953,145
Thayetmyo	91,329	25,686	2,569	66,372	33,186	2,212
Upper Chindwin	1,022,766	2,87,653	28,765	1,182,782	2,95,695	19,713
Yenangyat	3,176,231	8,93,315	89,331	2,510,533	7,84,541	52,303
Yenangyaung	176,285,048	4,95,80,170	4,958,017	184,420,141	5,18,68,165	3,457,878
Punjab—						
Attock	50,640	9,495	949	59,306	14,826	988
Mianwali	852	213	21	930	261	17
Total	293,116,834	*7,95,46,328*	*7,954,632*	305,683,227	*8,40,59,627*	*5,603,975*

During the year, there was a large decrease in the imports of kerosene oil, amounting to over 20 million gallons, the decrease being chiefly in the imports from Borneo, Persia and the Straits Settlements, set off by a small increase in the imports from the United States of America. During the same year, however, the export of paraffin wax increased from 23,093 tons, valued at £1,014,392, in the year 1920to 31,069 tons, valued at £940,623 in the year under review.

TABLE 22.—*Imports of Kerosene oil during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
From—	Gals.	Rs.	£	Gals.	Rs.	£
Borneo .	18,351,378	88,98,770	889,877	8,179,354	43,81,022	292,068
Persia .	7,234,277	51,92,060	519,206	236,374	1,77,280	11,819
Russia .	819,407	4,09,700	40,970	...	...	...
Straits Settlements (including Labuan).	4,909,819	26,09,460	260,946	5,025	7,388	493
United States of America.	32,283,533	2,93,74,330	2,937,433	34,441,518	2,73,50,225	1,823,348
Other Countries	746	1,760	176	1,504	1,567	104
Total .	**63,599,160**	*4,64,86,080*	*4,648,608*	**42,863,775**	*3,19,17,482*	*2,127,832*

TABLE 23.—*Exports of Paraffin Wax from India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
To—	Tons.	Rs.	£	Tons.	Rs.	£
United Kingdom.	6,752	27,80,600	278,060	5,013	22,80,915	152,061
Italy . .	...	...	...	10,270	46,72,850	311,523
China. .	1,160	5,27,800	52,780	2,429	10,86,906	72,460
Japan .	7,262	33,04,550	330,455	3,814	17,35,256	115,684
Egypt .	20	9,100	910	190	86,450	5,763
Portuguese East Africa.	560	2,54,800	25,480	50	22,750	1,517
United States of America.	914	4,15,470	41,547	1,134	5,15,970	34,398
Australia (including New Zealand).	4,040	18,38,200	183,820	1,708	8,08,402	53,899
Other Countries	2,385	10,13,400	101,340	6,401	28,99,768	193,318
Total .	**23,093**	*1,01,43,920*	*1,014,392*	**31,069**	*1,41,09,357*	*940,623*

Ruby, Sapphire and Spinel.

There was, during the year 1921, a considerable increase in the output of the ruby mines from 155,604 carats, valued at Rs. 6,19,820 (£61,982) in 1920 to 193,915 carats, valued at Rs. 7,52,468 (£50,165) in 1921.

TABLE 24.—*Quantity and value of Ruby, Sapphire and Spinel produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Carats.	Rs.	£	Carats.	Rs.	£
Burma—						
Mogok . .	88,491 (Rubies).	5,54,636	55,464	112,197 (Rubies).	6,91,209	46,081
	33,015 (Sapphires)	60,832	6,083	48,916 (Sapphires)	57,232	3,816
	34,098 (Spinels)	4,352	435	32,802 (Spinels)	4,027	268
Total . .	**155,604**	*6,19,820*	*61,982*	**193,915**	*7,52,468*	*50,165*

Salt.

There was a further decrease in the output of salt, amounting to nearly 100,000 tons in the year 1921. This decrease was borne largely by Northern India and Aden, the smaller decreases in Burma and Madras being balanced by a moderate increase in Bombay and Sind. The quantity of rock-salt produced decreased from 209,839 tons in 1920 to 148,038 tons in 1921. The imports of salt decreased from 614,674 tons, valued at £2,369,897, in 1920, to 479,306 tons valued at £1,052,984, in 1921.

TABLE 25.—*Quantity and value of Salt produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Aden . .	181,174	22,86,015	228,601	156,584	9.06,402	60,427
Bengal . .	30	553	55	35	1,160	77
Bombay and Sind	473,376	28,37,992	283,799	514,379	28,96,623	193,108
Burma . .	65,107	40,00,475	400,048	43,028	26,01.004	173,400
Central India .	12	797	80	1	72	5
Gwalior . .	232	11,045	1,104	159	7,585	506
Madras . .	453,547	29,78,471	297,847	446,113	26,22,460	174,831
Northern India .	456,538	23,43,308	234,331	373,184	20,87,279	139,152
Rajputana (Jaisalmer).	107	5,437	544	196	9,615	641
Total .	**1,630,123**	*1,44,64.093*	*1,446.409*	1,533,679	1,11,32,200	742,147

TABLE 26.—*Quantity and value of Rock-Salt produced in India during 1919 and 1920.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Salt Range .	181,480	6,17,536	61,754	123,084	5,98,823	39,922
Kohat . .	23,142	55,813	5,581	19,635	48,969	3,265
Mandi . .	5,217	93,195	9,319	5,319	1,28,968	8,598
Total .	**209,839**	*7,66,544*	*76,654*	**148,038**	*7,76,760*	*51,785*

TABLE 27.—*Quantity and value of Salt imported into India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
From—	Tons.	Rs.	£	Tons.	Rs.	£
United Kingdom.	93,440	38,22,180	382,218	73,756	26,63,389	177,559
Germany .	78,628	28,40,480	284,048	56,568	17,36,663	115,778
Spain . .	64,515	23,55,920	235,592	58,413	21,55,623	143,708
Aden and Dependencies.	194,269	75,73,110	757,311	142,044	44,94,987	299,666
Egypt .	131,326	50,79,260	507,926	97,694	30,78,881	205,259
Italian East Africa.	47,920	18,27,540	182,754	50,765	16,58,724	110,581
Other Countries	4,576	2,00,480	20,048	66	6,496	433
Total .	**614,674**	*2,36,98,970*	*2,369,897*	**479,306**	*1,57,94,763*	*1,052,984*

Saltpetre.

There was a fall in the total production of saltpetre of nearly 1,000 tons, representing chiefly the balance between a decrease of over 33 per cent. in the production of the Punjab and an increase of 22 per cent. in the output of Bihar. The figures for 1920 have been increased by the inclusion of the output of *kuthea* saltpetre produced in Bihar, which has not hitherto been included in the total. This not inconsiderable production of *kuthea* saltpetre is used in the manufacture of gunpowder and fireworks. The total Indian production of saltpetre in 1921 amounted to 15,894 tons, valued at Rs. 53,55,478 (£357,032). Exports decreased from 22,000 tons in 1920 to less than 13,000 tons in the year under review, the decreases being largely in the exports to the United Kingdom, Ceylon, Mauritius and the United States, with a considerable increase in the exports to Hongkong.

TABLE 28.—*Quantity and value of Saltpetre produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Bihar (refined) .	3,830	12,24,221	122,421	4,277	13,96,264	93,084
Do. (kuthea) .	1,855	5,08,415	50,842	2,681	5,86,464	39,098
Central India .	44	2,596	260	1·7	450	30
Punjab . .	6,548	25,82,376	258,238	4,339	19,04,208	126,947
Rajputana .	217	63,970	6,397	229	82,752	5,517
United Provinces	4,380	15,26,961	152,696	4,366	13,85,340	92,356
Total .	**16,874**	*59,08,539*	*590,854*	**15,893·7**	*53,55,478*	*357,032*

TABLE 29.—*Distribution of Saltpetre exported during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Cwts.	Rs.	£	Cwts.	Rs.	£
To—						
United Kingdom.	135,797	25,26,420	252,642	88,294	15,10,773	100,718
Ceylon . .	84,835	11,12,380	111,238	16,376	2,25,403	15,027
Hongkong .	28,072	4,95,590	49,559	65,241	14,74,118	98,275
Japan . .	2,292	35,300	3,530	498	11,540	769
Mauritius and Dependencies.	84,728	16,85,450	168,545	59,464	10,46,876	69,792
United States of America.	86,694	13,25,030	132,503	15,002	2,32,580	15,505
Other Countries	20,236	3,47,230	34,723	12,998	2,92,182	19,479
Total .	**442,654**	*75,27,400*	*752,740*	**257,873**	*47,93,472*	*319,565*

Silver.

The output of silver from Bawdwin again showed a considerable increase, whilst there were small decreases in the production of

silver from the Anantapur gold mines in Madras and the Kolar gold mines in Mysore. The total Indian production amounted to 3,587,587 ozs., valued at Rs. 88,95,121 (£593,008), corresponding to an average value of 39·7 pence per ounce, as compared with 2,906,397 ozs., valued at Rs. 84,31,092 (£843,109), corresponding to an average value of 69·6*d.* per ounce in the previous year.

TABLE 30.—*Quantity and value of Silver produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Ozs.	Rs.	£	Ozs.	Rs.	£
Burma—						
Northern Shan States.	2,869,727	83,37,362	833,736	3,555,021	88,20,855	588,057
Madras—						
Anantapur .	868	2,270	227	619	1,419	95
Mysore—						
Kolar . .	35,802	91,460	9,146	31,947	72,847	4,856
Total .	**2,906,397**	*84,31,092*	*843,109*	**3,587,587**	88,95,121	593,008

Tin.

In contrast to the previous year, when it was possible to record a considerable increase in the output of tin-ore, there was in the year under review a moderate decrease from an output of 2,117·6 tons of tin-ore (excluding the low-grade ore) in 1920 to 1,701·6 tons of tin-ore in 1921. The whole of this production was derived from Burma, Tavoy contributing 73 per cent. of the output and Mergui 24 per cent.; both these districts showed increases of production over the previous year, which increases were, however, more than balanced by an almost complete cessation of production in the Southern Shan States. In addition, Mergui produced 171·2 tons of block tin, showing a small increase over the figure for previous year. The imports of unwrought tin showed a small increase from 50,146 cwts. in 1920 to 53,114 cwts. in 1921. Of these imports by far the greater part came from the Straits Settlements.

TABLE 31.—*Quantity and value of Tin and Tin-ore for the years 1920 and 1921.*

	1920.						1921.					
	BLOCK TIN.			TIN-ORE.			BLOCK TIN.			TIN-ORE.		
	Quantity.	Value.		Quantity.	Value.		Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£	Tons.	Rs.	£	Tons.	Rs.	£
Bihar and Orissa—												
Hazaribagh .	1·6	2,847	285	..	..	..	..	..	..	..	..	..
Burma—												
Amherst .	..	..	..	41·5	49,200	4,920	..	..	..	30·9	30,948	2,063
Mergui .	163·3	5,02,793	50,279	366·2	5,74,658	57,466	171·2	4,62,104	30,807	409·9	5,95,306	39,687
Do. Low-grade ore.	..	..	..	1,220	91,500	9,150	..	..	..	..	..	..
Southern Shan States.	..	..	..	628·5	7,54,248	75,425	..	..	..	9·8	(a)	..
Tavoy . .	..	..	..	1,063	11,09,366	1,16,936	..	..	..	1,250	13,52,227	90,149
Do. Low-grade ore.	..	..	..	3	2,550	255	..	..	..	..	..	..
Thaton . .	..	..	..	18·4	19,102	1,910	..	..	..	·1	960	64
Total .	164·9	*5,95,640*	*59,564*	3,340·6	*26,60,624*	*266,062*	171·2	*4,62,104*	*30,807*	1,701·6	*19,79,441*	*131,963*

(a) Figures not available.

TABLE 32.—*Imports of Tin, unwrought (block, ingots, bars and slabs) into India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Cwts.	Rs.	£	Cwt.	Rs.	£
From—						
United Kingdom . .	2,165	4,64,540	46,454	2,148	3,05,230	20,349
Straits Settlements (including Labuan).	45,542	70,67,630	706,703	50,141	72,00,768	480,451
Other Countries . .	2,439	2,79,020	27,992	825	1,13,417	7,561
Total .	50,146	*78,12,090*	*781,209*	53,114	*76,25,415*	*508.361*

Wolfram.

The large decrease in the output of wolfram recorded for the year 1920 was followed by a still larger decrease in the year 1921, *viz.*, from 2,346·2 tons, valued at Rs. 13,97,075 (£139,707), in 1920 to 898·3 tons, valued at Rs. 4,39,388 (£29,292) in 1921. The whole of this output was derived from Burma, and all but about 12 tons from the Tavoy district.

TABLE 33.—*Quantity and value of Tungsten-ore produced in India, during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Burma—						
Mergui . .	191·5	1,73,352	17,335	4·9	1,597	106
Southern Shan States.	474·2	2,63,178	26,318	7·4	(*a*)	(*a*)
Tavoy .	1,679	9,59,420	95,942	886	4,37,791	29,186
Thaton .	1·5	1,125	112	...	...	...
Total .	2,346·2	*13,97,075*	*139,707*	898·3	*4,39,388*	*29,292*

(*a*) Not available.

III.—MINERALS OF GROUP II.

Alum.

The production of alum rose from 2,691 cwts., valued at Rs. 73,200 (£7,320), in 1920, to 3,380 cwts., valued at Rs. 64,400 (£4,293), in the year under review. The whole output came from the Mianwali district in the Punjab.

Amber.

There was a large decrease in the production of Amber from the Myitkyina district of Upper Burma, *viz.*, from 72 cwts., valued at Rs. 16,660 (£1,666), in 1920, to 26·3 cwts., valued at Rs. 16,840 (£1,123), in 1921.

Antimony.

There was a production of 32·5 cwts. of antimony-ore, valued at Rs. 250, from the Southern Shan States, and of 20 seers (about 40 lbs.) valued at Rs. 800 (£53), from the Jhelum district in the Punjab. The high value placed on the Jhelum product is due to its use as *surma*, for the eyes.

Aquamarine and Beryl.

27·5 seers of aquamarine, 173·5 seers of beryl, and 12 seers of rock-crystal, valued altogether at Rs. 19,000 (£1,267), were produced in Kashmir. Ajmer-Merwara (in Rajputana) records a production of 6,300 carats of beryl, valued at Rs. 100 (£6·7), the low value of the beryl from Rajputana being an index of the poor quality of the mineral won.

Asbestos.

In 1920 the output of asbestos totalled 1,818 tons, of which 1,711 tons came from the district of Hassan, and the balance, 107 tons, from the district of Bangalore, in Mysore State. In the year under review the production from these two districts fell to 237 and 67 tons respectively, with a total value of Rs. 12,160 (£811). In addition, 11½ tons of asbestos were produced in the Seraikela State, Singhbhum, valued at Rs. 1,100 (£73).

Barytes.

1,457 tons of barytes, valued at Rs. 47,603 (£3,173), were produced in 1921 in the Kurnool District of the Madras Presidency, against 678 tons valued at Rs. 15,528 (£1,553) in 1920. In addition, there was an output of 234 tons of barytes, valued at Rs. 4,680 (£312) in Alwar State in Rajputana.

TABLE 34.—*Production of Building Materials and Road Metal in India during 1921.*

	Granite and Gneiss.		Laterite.		Lime.		Limestone and Kankar.		Marble.		Sandstone.		Slate.		Trap.		Miscellaneous.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons	£	Tons	£	Tons	£	Tons	£	Tons	£	Tons	£	Tons	£	Tons	£	Tons	£
Assam	8,364	1,348	(a)2,600	293	...	...	98,391	15,034	...	...	...	...	...	..		...	88,621	13,173
Baroda	182	333	...	...	...	...	...	..	143	200	...	...	...	...	...	...	...	...
Bihar and Orissa	...	...	560	23	53,474	11,324	471,977	46,871	...	...	14,718	1,325	2,829	3,016	19,461	3,028	517,834	13,098
Burma	72,932	7,772	287,527	35,005	...	...	236,451	20,069	...	...	318,456	13,016	...	...	39,154	1,500	597,907	28,290
Central India	...	...	...	...	24,539	35,094	203,716	9,732	...	...	21,411	7,167	...	...	...	...	918	542
Central Provinces	...	...	...	...	...	...	335,349	36,333	...	...	...	...	...	...	...	...	...	...
Madras	26,218	939	58,751	3,014	...	...	17,460	4,271	...	...	...	...	213	23	...	...	89,321	9,977
Mysore	...	...	...	...	1,147	279	306	130	...	...	...	...	1	...	...	...	3,519	525
N.-W. F. Province	...	...	...	...	...	...	4,671	290	...	...	...	...	...	...	...	...	...	...
Punjab	...	...	...	...	...	...	30,597	2,129	...	...	...	...	47,508 (b)	8,105	...	...	84,625	6,762
Rajputana	...	...	...	...	16,285	880	1,133 (e)	164	..	...	35,111	16,468	185	...	...	...	53,759 (e)	13,323
United Provinces	...	...	...	...	...	...	363,607 (f)	16,017	...	...	8,909	327	1,977	398	...	...	204,467	33,712
Total	107,696	*10,392*	349,438	*38,335*	95,445	*47,577*	1,763,658	*151,040*	8,853 (d)	*200*	398,605	*39,303*	52,713 (g)	*11,542*	58,615	*4,528*	1,640,971	*119,402*

GRAND TOTAL . 4,467,098 tons valued at *£422,219*.

(a) Does not include 1,600 tons for which value not known.
(b) Does not include 337,500 slates valued at £900, weight unknown.
(d) Does not include 8,710 tons for which value not received.
(e) Does not include 69,798 tons and 9,383 units for which value not received.
(f) Does not include 106,751 tons for which values not received.
(g) Does not include 186 tons for which value not received.

Bauxite.

There was again a considerable increase in the production of bauxite from Kaira in Bombay, from 3,931·5 tons, valued at Rs. 41,280 (£4,128), to 4,653 tons, valued at Rs. 39,550 (£2,637) in 1921 for use in the refining of oil. In addition, there was an output at Katni in the Jubbulpore district in 1920 of 2,368 tons of bauxite valued at Rs. 12,028 (£1,203) falling in 1921 to 1,999 tons, valued at Rs. 9,651 (£643), for use mainly in the cement industry. Investigations were continued on the important bauxite deposits discovered in Jammu and referred to in the previous Review, but hitherto with no tangible result.

Building Materials.

The total estimated value of building stone and road-metal produced in the year under review was Rs. 63,33,285 (£422,219). Certain figures returned only in cubic feet have been converted into tons on the basis of certain assumed relations between volume and weight.

Clay.

The recorded production of clay rose from 156,524 tons, valued at Rs. 4,08,121 (£40,812), in 1920, to 199,266, valued at Rs. 5,60,664 (£37,378) in 1921.

TABLE 35.—*Production of Clays in India during 1921.*

—	Quantity.	Value.	
	Tons.	Rs.	£
Bengal	9,117	10,413	1,294
Bihar and Orissa	32,280	3,35,177	22,345
Burma	39,321	27,765	1,851
Central India	669	1,630	109
Central Provinces	52,284	31,869	2,125
Kashmir	2	45	3
Mysore	52,328	1,15,156	7,677
Punjab	12,801	28,449	1,897
Rajputana (*a*)	464	1,160	77
Total	199,266	560,664	37,378

(*a*) Value of 90 tons from Alwar not included.

Fuller's Earth.

The production of fuller's earth is recorded separately, and amounted to, in 1921, 2,807 tons, valued at Rs. 14,490 (£966).

TABLE 36.—*Production of Fuller's Earth in India during 1921.*

	Quantity.	Value.	
	Tons.	Rs.	£
Central Provinces—			
Jubbulpore	113	554	37
Mysore—			
Tumkur	139	195	13
Rajputana—			
Bikaner	1,675	8,799	587
Jodhpur	880	4,942	329
Total	2,807	*14,490*	*966*

Garnet.

An output of 407·4 cwts. of garnet in 1920 was reported from Hyderabad. No returns have been received for the year under review.

Gypsum.

The production of gypsum showed a slight increase, the total output being 33,801 tons, valued at Rs. 34,018 (£2,267), as against 33,551 tons, valued at Rs. 36,932 (£3,693) in 1920.

TABLE 37.—*Production of Gypsum during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Punjab—						
Jhelum	7,378	17,218	1,722	5,329	4,663	311
Rajputana—						
Bikanir	16,173	13,122	1,312	16,285	13,204	880
Marwar	10,000	6,592	659	12,000	5,000	333
Kashmir	...	...	...	187	11,151	743
Total	**33,551**	*36,932*	*3,693*	**33,801**	*34,018*	*2,267*

Molybdenite.

Only 2 cwts. of molybdenite, valued at Rs. 200 (£13), were won during the year 1921; this amount was recovered in the course of wolfram-mining operations in Tavoy.

Ochre.

The output of ochre for which figures of both quantity and value have been supplied increased from 2,635 tons, valued at Rs. 33,431 (£3,343), in 1920, to 5,812 tons, valued at Rs. 32,606 (£2,174) in 1921.

TABLE 38.—*Production of Ochre during the years 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Bihar and Orissa	400	20,000	2,000	450	12,600	840
Burma . .	...	...	...	...	...	...
Central India (*a*)	1,001	10,307	1,031	3,877	15,200	1,013·3
Central Provinces (*b*).	...	...	...	221	126	8·4
Gwalior . .	1,082	1,900	190	1,014	2,180	145·3
Madras . .	100	600	60	...	...	..
Mysore . .	52	624	62	250	2,500	167
Total .	**2,635**	*33,431*	*3,343*	**5,812**	*32,606*	*2,174*

(*a*) Ochre (weight not reported) valued at Rs. 1,014 from Kothi and 2,000 tons of ochre (value not reported) from Bundelkhand not included.
(*b*) 60 tons of ochre (value not reported) from Chanda not included.

Phosphates.

347 tons of apatite valued at Rs. 3,420 (£231), were produced in the Singhbhum district in 1921.

Soda.

10 tons of soda, valued at 30 seers per rupee, were produced in the Ladak tahsil, Kashmir, in the year 1921.

Steatite.

The output of steatite rose by 35 per cent., from 3,681 tons, valued at Rs. 1,05,554 (£10,585), to 5,703 tons, valued at Rs. 88,202 (£5,809).

TABLE 39.—*Quantity and value of Steatite produced in India during 1920 and 1921.*

	1920.			1921.		
	Quantity.	Value.		Quantity.	Value.	
	Tons.	Rs.	£	Tons.	Rs.	£
Bihar and Orissa—						
Bhagalpur	..	..	..	90	900	60
Mayurbhanj	52	3,600	360	62	3,850	257
Singhbhum	412	25,409	2,541	27	3,356	224
Burma—						
Meiktila	..	..	..	3,152	22,233	1,482
Myingyan	..	..	..	107	964	64
Pakokku Hill Tracts	·4	105	10·5	1·5	270	18
Sagaing	..	..	..	374	3,223	215
Central Provinces—						
Jubbulpore	2,295·5	43,342	4,334	1,080	19,699	1,313
Madras—						
Bellary	3	15	1·5	..	..	..
Nellore	32	2,864	286	40·5	5,866	391
Salem	538·5	14,650	1,465	528	13,987	932
Mysore—	205	5,300	530	138	414	28
United Provinces—						
Hamirpur	73	10,069	1,007	98	13,200	880
Jhansi	10	500	50	5	240	16
Total	3,681·4	*1,05,854*	*10,585*	5,703	*88,202*	*5,880*

IV.—MINERAL CONCESSIONS GRANTED.

TABLE 40.—*Statement of Mineral Concessions granted during 1921.*

ASSAM.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Cachar .	(1) The Burma Oil Co., Ltd.	Mineral oil . .	P. L. .	6,169·6	8th April 1921	1 year.
Do. .	(2) Do. .	Do. . .	P. L. .	4,409·6	12th April 1921.	Do.
Do. .	(3) Do. .	Do. . .	P. L. .	4,947·2	26th September 1921.	Do.
Do. .	(4) The Indo-Burma Petroleum Co., Ltd.	Do. . .	P. L. .	5,056	4th March 1921.	Do.
Garo Hills .	(5) Messrs. Kilburn & Co., on behalf of Garo Hills Mining Syndicate.	Coal . . .	P. L. .	49,280	9th May 1921	Do.
Khasi and Jaintia Hills.	(6) The Khasia Mines, Ltd.	Minerals other than mineral oil.	P. L. .	7,564·8	10th January 1921.	Do.
Sylhet .	(7) The Burma Oil Co., Ltd.	Mineral oil . .	P. L. .	4,691·2	22nd March 1921.	Do.
Do. .	(8) The Indo-Burma Petroleum Co., Ltd.	Do. .	P. L. .	3,008	31st August 1921.	Do.

BALUCHISTAN.

Kalat .	(9) The Whitehall Petroleum Corporation Ltd. of London.	Mineral oil . .	E. L. .	Bolan Pass .	18th March 1921.	1 year.
Do. .	(10) Do. .	Do. . .	E. L. .	Whole of the Lasbela State.	30th March 1921.	Do.
Do. .	(11) Do. .	Do. . .	E. L. .	Whole of the Kalat State.	30th March 1921.	Do.
Do. .	(12) The Burma Oil Co. of Rangoon.	Oil . . .	P. L. .	3,200	1st September 1921.	Do.
Quetta Pishin.	(13) General Manager, Baluchistan Chrome Co., Ltd., Hindubagh.	Chromite . .	M. L. .	10	1st April 1921.	30 years.
Sibi . .	(13) Captain R. C. Blackwood on behalf of the Whitehall Petroleum Co., Ltd., of London.	Crude Petroleum and its associated Hydro-carbons.	P. L. .	49,606·4	28th December 1921.	2 years.
Do. .	(15) Do. .	Mineral oil . .	E. L. .	Whole of Sibi District except Marri and Bugti countries.	24th May 1921.	1 year.

P. L.—*Prospecting License.* M. L.—*Mining Lease.* E. L.—Exploring License.

BALUCHISTAN—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Zhob . .	(16) Baluchistan Chrome Co., Ltd., Hindubagh.	Chromite . .	M. L. .	10	1st July 1921	30 years.
Do. .	(17) Do. .	Do. . .	M. L. .	10	1st July 1921	Do.
Do. .	(18) Do. .	Do. . .	M. L. .	10	1st July 1921	Do.
Do. .	(19) Do. .	Asbestos . .	M. L. .	20	1st July 1921	Not given in the lease.

BENGAL.

Chittagong .	(20) Burma Oil Co., Ltd.	Mineral oil . .	P. L. .	4,000	12th December 1921.	2 years only.

BIHAR AND ORISSA.

Gaya .	(21) M. Kumar Krishna Mittra.	Mica . . .	M. L. .	486·6	....	15 years.
Hazaribagh.	(22) Babu Dvijendra Nath Mukherji.	Do. . . .	P. L. .	65	27th February 1921.	1 year.
Do. .	(23) Babu Harihar Nath Singh.	Do. . . .	P. L. .	140	20th January 1921.	Do.
Do. .	(24) Babu Girish Chandra Sen.	Do. . . .	P. L. .	97·80	28th April 1921.	Do.
Do. .	(25) Babu Banka Bihari Chaudhuri.	Do. . . .	P. L. .	280	18th May 1921.	Do.
Do. .	(26) Babu Lakshmi Narain Sukhani.	Do. . .	M. L. .	120	12th September 1921.	30 years.
Do. .	(27) Babu Bhujendra Nath Dass.	Do. . . .	M. L. .	440	10th November 1921.	Do.
Sambalpur .	(28) Babu Shanker Prashad Misra.	Coal . . .	P. L. .	2,874·80	23rd May 1921.	1 year.
Do. .	(29) Do. .	Oxide of Iron .	P. L. .	86·91	...	Do.
Do. .	(30) Seth Puranmal Marwari.	Mica . . .	M. L. .	591·20	10th May 1921.	30 years.
Do. .	(31) Do. .	Do. . . .	M. L. .	154·56	10th May 1921.	Do.
Do.	(32) Mr. J. Sonbolle .	Coal . . .	P. L. .	1,123·40	6th September 1921.	1 year.
Do. .	(33) Do. .	Do. . . .	P. L. .	1,434	6th September 1921.	Do.
Do.	(34) Babu Debi Prasad Misra.	Do. . . .	P. L. .	2,376·99	28th November 1921.	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.* E. L.—Exploring License.

BIHAR AND ORISSA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Sambalpur .	(35) Seth Puranmal Marwari.	Mica . . .	P. L. .	80·98	20th December 1921.	1 year.
Santhal Parganas.	(36) Babu Jetha Mulji .	Coal . . .	M. L. .	5	1st April 1921	2 years.
Do. .	(37) Babu Bhudhar Chandra De.	Do. . . .	M. L. .	·99	1st April 1921	Do.
Do. .	(38) Do. .	Do. . . .	M. L. .	·99	1st April 1921	Do.
Do. .	(39) Babu Binod Bihari De.	Do. . . .	M. L. .	2·15	1st April 1921	Do.
Do. .	(40) Babu Girish Chandra Mandal.	Do. . . .	M. L. .	·92	1st April 1921	Do.
Do. .	(41) Do. .	Do. . . .	M. L. .	2·16	1st April 1921	Do.
Do. .	(42) Do. .	Do. . . .	M. L. .	1·62	1st April 1921	Do.
Do. .	(43) Babu Bansi Ram Marwari.	Do. . . .	M. L. .	1·0	1st April 1921	Do.
Do. .	(44) Do. .	Do. . . .	M. L. .	·3	1st April 1921	Do.
Do. .	(45) Babu Ganga Ram Marwari.	Do. . . .	M. L. .	2·6	1st April 1921	Do.
Do. .	(46) Babu Bhudhar Chandra De.	Do. . . .	M. L. .	1·64	1st August 1921.	1 year and 8 months.
Singhbhum .	(47) Babu Jogendra Nath Roy.	Chromite . .	P. L. .	172	15th January 1921.	1 year.
Do. .	(48) The Villiers Colliery Company, Ltd.	Iron Ore . .	P. L. .	371·20	9th February 1921.	Do.
Do. .	(49) Babu Arjun Ladha	Manganese . .	P. L. .	72	20th April 1921.	Do.
Do. .	(50) The Villiers Colliery Co., Ltd.	Iron Ore . .	P. L. .	020·8	9th May 1921	Do.
Do. .	(51) Babu Rajanikanta Pattadar, M.B.E.	Do. . . .	P. L. .	2,560	11th June 1921.	Do.
Do. .	(52) Messrs. Byramjee Pestonjee and Co.	Do. . . .	P. L. .	1,708·4	13th May 1921.	Do.
Do. .	(53) Babu Rajani Kanta Pattadar, M.B.E.	Chromite . .	P. L. .	1,004·8	13th May 1921.	Do.
Do. .	(54) The Nagpur Clay Co., Ltd.	All minerals .	P. L. .	529·60	License not yet executed.	Do.
Do. .	(55) The Orissa Minerals Development Company, Ltd.	Iron Ore and manganese. .	M. L. .	2,624	Lease not yet executed.	30 years.
Do. .	(56) Mr. A. N. Paston James.	Iron Ore . .	P. L. .	1,110	8th December 1921.	1 year.
Do. .	(57) The Nagpur Clay Co., Ltd.	All minerals .	P. L. .	3,140·71	25th November 1921.	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

BOMBAY.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Belgaum .	(58) Messrs. Tata & Sons	Manganese .	P. L. .	499·65	10th January 1921.	1 year.
Savantwadi State.	(59) Messrs. Dalchand Bahadur Singh of Calcutta.	Bauxite . .	P. L .	620	License not yet executed.	Do.

BURMA.

Akyab .	(60) Messrs. The Indo-Burma Petroleum Co., Ltd.	Mineral oil .	P. L. . (renewal.)	5,440	15th December 1920.	1 year.
Do. .	(61) Messrs. The Indo-Burma Petroleum Co	Do. .	P. L. .	1,280	22nd April 1921.	Do.
Amherst .	(62) Maung Saw Maung and Ma Kywe.	All minerals (except oil)	P. L. .	640	21st March 1921.	Do.
Do. .	(63) Mr. A. C. Jeewa .	Do. .	P. L. .	640	15th March 1921.	Do.
Do. .	(64) Maung Ba Han .	Do. .	P. L. .	1,830·88	21st June 1921.	Do.
Do. .	(65) K. E. I. Solomon .	Do. .	P. L. .	1,280	29th June 1921.	Do.
Do. .	(66) K. P. M. K. Narayan Chetty.	Do. .	P. L. .	2,240	11th June 1921.	Do.
Do. .	(67) Messrs. Cookson & Co., Ltd.	Do. .	P. L. .	319	23rd June 1921.	Do.
Do. .	(68) Mr. R. A. Park .	Do. .	P. L. .	960	7th June 1921.	Do.
Do. .	(69) K. P. M. K. Narayan Chetty.	Do. .	P. L. .	1,280	11th June 1921.	Do.
Do. .	(70) Saw Lein Lee .	Do. .	P. L. . (renewal).	640	5th April 1921.	Do.
Do. .	(71) A. C. Jeewa . .	Do. .	P. L. . (renewal).	640	8th May 1921	Do.
Do. .	(72) Messrs. The Talaing Exploration Syndicate.	All minerals .	P. L. . (renewal).	2,880	16th November 1921.	2 years.
Do. .	(73) Dr. M. Shawloo .	All minerals (except oil).	P. L. . (renewal).	640	21st January 1921.	1 year.
Do. .	(74) Saw Eu Hoke .	Do. .	P. L. .	4,480	17th February 1921.	Do.
Do. .	(75) Maung Po Thine & One.	Do. .	P. L. .	1,280	26th September 1921.	Do.
Do. .	(76) M. E. Moola .	Oil shale . .	P L. .	22,822·4	27th August 1921.	Do.
Do. .	(77) Maung Choon .	All minerals (except oil).	P. L. .	640	31st August 1921.	Do.

P. L.=*Prospecting Licenses.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Amherst .	(78) Messrs. Balthazar & Son.	All minerals (except oil).	P. L. .	640	9th September 1921.	1 year.
Do. .	(79) Mrs. M. M. Hla Aung.	Do. .	P. L. . (renewal).	2,880	16th November 1920.	Do.
Do. .	(80) K. P. N. K. Narayan Chetty.	Do. .	P. L. . (renewal).	320	5th August 1921.	Do.
Do. .	(81) Maung On Maung .	All minerals .	P. L. .	1,280	5th December 1921.	Do.
Do. .	(82) Saw Lein Lee .	Do. .	P. L. .	640	1st November 1921.	Do.
Henzada .	(83) Mr. L. D'Attaides .	All minerals (except oil)	P. L. .	148·80	8th June 1921	Do.
Do. .	(84) Mohamed Idries .	Mineral oil . .	P. L. .	2,042·50	12th April 1921.	Do.
Do. .	(85) Mr. L. D'Attaldes .	All minerals (except oil).	P. L. . (renewal).	1,320	11th April 1921.	2 years.
Do. .	(86) Su Kwin Ping .	Mineral oil . .	P. L. .	761·6	9th September 1921.	1 year.
Do. .	(87) U Po Tha . .	Coal . . .	P. L. .	7,558·4	5th September 1921.	Do.
Do. .	(88) Messrs. H. Abdul Shakoor Hajee Cassim and Sons.	All minerals including mineral oil.	P. L. .	2,560	26th September 1921.	Do.
Katha .	(89) Ma Ma . .	All minerals (except oil).	P. L. .	1,280	6th May 1921	Do.
Do. .	(90) Ma Kyaw . .	Do. .	P. L. .	640	7th May 1921	Do.
Do. .	(91) Chan Chor Khine .	Do. .	P. L. .	2,084	24th March 1921.	Do.
Do. .	(92) Maung Shu Maung	Do. .	P. L. .	960	18th June 1921.	Do.
Do. .	(93) Do. .	Do. .	P. L. .	640	31st May 1921.	Do.
Do. .	(94) Jamal Brothers & Co.	Do. .	P. L. .	27,865·6	31st August 1921.	Do.
Do. .	(95) Maung Po Hte	Do. .	P. L. .	2,560	23rd August 1921.	Do.
Do. .	(96) Maung Pan Nyo .	Do. .	P. L. .	640	20th October 1921.	Do.
Do. .	(97) Maung Po Hte .	Do. .	P. L. .	3,200	21st September 1921.	Do.
Do. .	(98) Ko Ko Gyi . .	Do. .	P. L. . (renewal).	3,840	12th August 1921.	Do.
Kyaukpyu .	(99) Messrs. The Burma Oil Co., Ltd.	Mineral oil . .	P. L. . (renewal).	2,105·6	27th May 1921.	2 years.
Kyaukse .	(100) Maung Aung Ko .	All minerals (except oil).	P. L. .	2,650	8th February 1921.	1 year.

P. L.=*Prospecting License.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Lower Chindwin.	(101) Mr. Lawrence Dawson.	Mineral oil . .	P. L. .	3,008	17th February 1921.	1 year.
Do. .	(102) Indo-Burma Petroleum Co.	Do. . .	P. L. .	9,920	23rd August 1921.	Do.
Do. .	(103) Do. .	Do. . .	P. L. .	3,200	23rd August 1921	Do.
Do. .	(104) Do. .	Do. . .	P. L. .	6,553·6	19th September 1921	Do.
Do. .	(105) Do. .	Do. . .	P. L. .	5,248	2nd September 1921.	Do.
Do. .	(106) Do. .	Do. . .	P. L. .	3,200	25th October 1921.	Do.
Do. .	(107) Messrs. The Burma Finance and Mining Co, Ltd.	All minerals including mineral oil.	P. L. .	16,480	13th October 1921.	Do.
Do. .	(108) Do. .	Do. . .	P. L. .	9,440	13th October 1921.	Do.
Do. .	(109) Messrs. The Indo-Burma Oil-fields (1920), Ltd.	Mineral oil . .	P. L. .	2,560	13th October 1921.	Do.
Do. .	(110) Do. .	Do. . .	P. L. .	1,280	13th October 1921.	Do.
Do. .	(111) Messrs. Indo-Burma Petroleum Co., Ltd.	Do. . .	P. L. .	8,060	12th December 1921.	Do.
Do. .	(112) Maung Kyaw .	Do. . .	P. L. . (renewal).	9,600	25th October 1921.	2 years.
Magwe	(113) Maung Po Kin .	Do. . .	P. L. .	1,280	7th March 1921.	1 year.
Do. .	(114) Maung Po Tun .	Do. . .	P. L. .	1,280	Do.	Do.
Do. .	(115) Do. .	Do. . .	P. L. .	960	15th March 1921.	Do.
Do. .	(116) Mr. G. H. Surty .	Do. . .	P. L. . (renewal).	640	21st February 1921.	Do.
Do. .	(117) Maung Po Aung .	Do. . .	P. L. .	640	26th May 1921.	Do.
Do. .	(118) Union Oil Company.	Petroleum . .	P. L. .	960	29th August 1921.	Do.
Do. .	(119) Sasson Solomon .	Do. . .	P. L. .	640	14th July 1921.	Do.
Do. .	(120) H. E. Malin .	Do. . .	P. L. .	640	20th August 1921.	Do.
Do. .	(121) Maung Kin . .	Gold . . .	P. L. .	800	21st August 1921.	Do.
Do. .	(122) Burma Oil Co. .	Petroleum . .	P. L. .	2,259·2	25th June 1921.	Do.

P. L.=*Prospecting License.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Magwe	(123) Maung Po Sau	Petroleum	P. L.	640	9th June 1921.	1 year.
Do.	(124) M. E. Moolla	Mineral oil	P. L.	1,050	18th June 1921.	Do.
Do.	(125) Messrs. The Burma Oil Co.	Do.	M. L.	1,020	1st August 1919.	30 years.
Do.	(126) Maung Maung Pe.	Do.	P. L.	1,280	16th November 1921.	1 year.
Do.	(127) Mr. A. Davies	Do.	P. L.	2,880	Do.	Do.
Do.	(128) Abdul Rahman	Do.	P. L.	76	11th November 1921.	Do.
Do.	(129) Do.	Do.	P. L.	640	Do.	Do.
Do.	(130) Jaffer Ali Tar Mahamed.	Do.	P. L.	640	5th December 1921.	Do.
Do.	(131) Messrs. The Union Oil Co.	Do.	P. L. (renewal).	20,480	21st January 1921.	2 years.
Do.	(132) Messrs. The Burma Oil Co., Ltd.	Do.	P. L. (renewal).	3,840	2nd June 1921.	1 year.
Mandalay	(133) Messrs. The Burma Mines, Ltd.	Iron ore	P. L.	3,640	17th June 1921.	Do.
Do.	(134) Sir Abdul Jamal	All minerals (except oil).	P. L.	3,200	2nd June 1921.	Do.
Do.	(135) Messrs. Steel Bros. & Co., Ltd.	Do.	P.L.	2,560	1st October 1921.	Do.
Mergui	(136) Mr. A. C. C. Rogers	Do.	P. L.	1,873·92	14th January 1921.	Do.
Do.	(137) Messrs. The Burma Finance and Mining Co., Ltd.	Coal	P. L.	1,076·52	7th January 1921.	Do.
Do.	(138) Do.	Do.	P. L.	1,409·60	Do.	Do.
Do.	(139) Mr. C. Chan Shwe	All minerals (except oil).	P. L.	547·84	20th December 1920.	Do.
Do.	(140) Mr. S. O. Holmes	Do.	P. L.	624·64	7th March 1921.	Do.
Do.	(141) Maung Choon	Tin and allied minerals.	P. L. (renewal).	25·37	22nd November 1920.	6 months.
Do.	(142) Saw Loin Lee	Do.	P. L.	640	27th June 1921.	1 year.
Do.	(143) Mr. S. O. Holmes	All minerals (except oil).	P. L.	327·68	1st April 1921.	Do.
Do.	(144) The Mergui Tin Dredging Co., Ltd.	Do.	P. L.	240·64	7th April 1921.	Do.
Do.	(145) Mr. M. E. Bhymeah	Do.	P. L. (renewal).	414·72	1st December 1920	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Mergui .	(146) Mr. W. H. Olivent	All minerals (except oil).	P. L. (renewal).	286·72	19th January 1921.	1 year.
Do. .	(147) Do. . .	Do. . .	P. L. (renewal).	442 88	Do.	Do.
Do. .	(148) Maung Po Thaik	Tin and Wolfram	P L. (renewal).	486·40	13th February 1921.	6 months.
Do. .	(149) Aung Sein Swai	All minerals (except oil).	P. L. (renewal).	2,088·96	12th January 1921.	1 year.
Do. .	(150) Mr. Chas. Ellis .	Tin . . .	P. L. (renewal).	701·44	5th May 1921	Do.
Do. .	(151) Lim Shain .	Tin and Wolfram	P. L. (renewal.	517 36	17th February 1921.	Do.
Do. .	(152) Messrs. H. V. Low & Co., Ltd.	All minerals (except oil.)	P. L. (renewal.)	814·08	16th August 1921.	Do.
Do. .	(153) Do. . .	Do. . .	P. L. (renewal).	1,433·60	Do.	Do.
Do. .	(154) Do. . .	Do. . .	P. L. (renewal).	1,889·28	Do.	Do.
Do. .	(155) Maung Po Thaik	Tin and Wolfram	P. L. (renewal).	486·40	13th August 1921.	6 months.
Do. .	(156) Mr. C. Chan Shwe	All minerals (except oil).	P. L. (renewal).	2,362·88	6th September 1921.	1 year.
Do. .	(157) Maung E. Gyi .	Tin and allied minerals.	P. L. (renewal).	640·00	4th October 1921.	Do.
Do. .	(158) Mr. C. Chan Shwe	All minerals (except oil).	P. L. (renewal).	1,351·68	2nd February 1921.	Do.
Do. .	(159) A. S. Mahomed	Tin, Wolfram and allied minerals.	P. L. (renewal).	3,008	12th March 1921.	Do.
Do. .	(160) Messrs. H. V. Low & Co., Ltd.	All minerals (except oil).	P. L. (renewal).	1,203·20	9th September 1920.	Do.
Do. .	(161) Mr. T. Greenhow	Tin and Wolfram	P. L. (renwal).	194·56	14th March 1921.	Do.
Do. .	(162) Maung Choon .	Tin and allied minerals.	P. L. (renewal)	25·37	23rd May 1921.	6 months.
Do. .	(163) Messrs. The Mergui Tin Dredging Co., Ltd.	Tin and Wolfram	M. L .	110·40	19th May 1917.	30 years.
Do. .	(164) Do. . .	All minerals (except oil.)	M. L. .	158·86	24th February 1919.	Do.
Do. .	(165) Yew Shwe Ni .	Do. . .	M. L. .	1,518·51	5th May 1919	Do.
Do. .	(166) Mr. W. B. Abreu	Tin . . .	P. L. .	3,276·80	8th August 1921.	1 year.
Do.	(167) Mr. W. H. Olivant	All minerals (except oil).	P. L. .	2,046·80	30th July 1921.	Do.

P. L. = *Prospecting Licence.* M. L. = *Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Mergui .	(168) Mr. J. T. Doupe .	Tin . . .	P. L. .	640	19th August 1921.	1 year.
Do. .	(169) Messrs. The Burmese Minerals Exploration, Ltd.	Do. . . .	P. L. .	519·68	30th July 1921.	Do.
Do. .	(170) Mr. V. A. R. Sutherland.	Cassiterite and gold.	P. L. .	640	22nd July 1921.	Do.
Do. .	(171) Messrs. The Mergui Tin Dredging Co., Ltd.	Wolfram and tin	P. L. . (renewal)	2,150·40	2nd November 1920.	Do.
Do. .	(172) Maung Po Kin .	Wolfram, tin and allied minerals.	P. L. . (renewal).	250·88	6th February 1921.	6 months.
Do. .	(173) Do. . .	Do. . .	P. L. . (renewal).	788·48	Do.	Do.
Do. .	(174) Messrs. The Mergui Tin Dredging Co., Ltd.	Tin and allied minerals.	P. L. . (renewal).	1,802·24	16th February 1921.	1 year.
Do. .	(175) Mr. J. F. Leslie .	All minerals (except oil).	P. L. . (renewal).	798·72	18th February 1921.	6 months.
Do. .	(176) Mr. Charles Kitchen	Do. . .	P. L. . (renewal).	716·80	28th May 1921.	1 year.
Do. .	(177) Maung E Gyi .	Tin and allied minerals.	P. L. . (renewal).	588·80	14th May 1921.	Do.
Do. .	(178) Maung Po Thaik	Tin . . .	P. L. . (renewal).	60·56	10th June 1921.	Do.
Do. .	(179) Messrs. The Leibaoak Syndicate, Ld.	All minerals (except oil).	P. L. . (renewal).	1,239·04	21st May 1921.	Do.
Do. .	(180) Mr. T. Greenhow	Tin and Wolfram	P. L. . (renewal).	4,597·76	14th July 1921.	Do.
Do. .	(181) Maung Po Kin .	Wolfram, tin and allied minerals.	P. L. . (renewal).	250·88	6th August 1921.	6 months.
Do. .	(182) Do. . .	Do. . .	P. L. . (renewal).	788·48	6th August 1921.	Do.
Do. .	(183) Saw Lein Lee .	Tin and allied minerals.	P. L. .	640	27th June 1921.	1 year.
Do. .	(184) Mr. A. E. Ahmed	Wolfram, tin and Allied. minerals.	P. L. .	844·80	16th September 1921.	Do.
Do. .	(185) Maung San Dun .	Do. . .	P. L. .	1,120	27th October 1921.	Do.
Do. .	(186) Mr. A. C. Martin	All minerals (except oil).	P. L. .	2,060·80	28th October 1921.	Do.
Do. .	(187) Mr. Chan Khain Lock.	Do. . .	P. L. .	2,156·24	14th October 1921.	Do.
Minbu .	(188) Messrs. The British Burma Petroleum Co., Ltd.	Mineral oil . .	M. L. .	471·72	3rd August 1910.	30 years.
Do. .	(189) Messrs. The Union Oil Co., of Burma, Ltd.	Do. . .	P. L. .	3,168	17th February 1921.	1 year.

P. L.=*Prospecting License.* M.L.=*Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Minbu .	(190) Messrs. The Irrawaddy Petroleum Oil Syndicate, Ltd.	Mineral oil . .	P. L. .	640 (block 16 S. in Minbu oil field).	5th March	1 year.
Do. .	(191) Mr. A. Rahim .	Do. . .	P. L. .	2,904	3rd March 1921.	Do.
Do. .	(192) Mr. Ali Hashim Mehtar.	Do. . .	P. L. .	408	14th March 1921.	Do.
Do. .	(193) Mr. M. G. H. Surty	Coal . . .	P. L. . (renewal).	4,857·6	28th January 1921.	Do.
Do. .	(194) Mr. Yeo Eng Byan	Do. . . .	P. L. . (renewal).	1,542	Do.	Do.
Do. .	(195) Messrs. The British Burma Petroleum Co.	Mineral oil . .	P. L. . (renewal).	388	12th February 1921.	Do.
Do. .	(196) Irrawaddy Petroleum Oil Syndicate Ltd.	Do. . .	P. L. .	23·76	16th July 1921.	Do.
Do. .	(197) Maung Tha Ya .	Do. . .	P. L. .	320 (block 3 S. in Minbu oil field).	5th July 1921	Do.
Do. .	(198) Do. . .	Do. . .	P. L. .	160 Acres in block 10 S. in Minbu oil field.	Do.	Do.
Do. .	(199) Yomah Oil Co., (1920) Ltd.	Coal . . .	P. L. . (renewal).	480	1st April 1921	Do.
Do. .	(200) Messrs. The Union Oil Co., Ltd.	Mineral oil . .	P. L. . (renewal).	38,400	8th January 1921.	Do.
Do. .	(201) Mr. Sulaiman .	Do. . .	P. L. . (renewal).	320 (Northern half of block 16 N in the Minbu oil field.)	6th May 1921	Do.
Myingyan .	(202) Messrs. The Union Oil Co.	Do. .	P. L. . (renewal).	6,720	17th September 1920.	2 years.
Do. .	(203) Messrs. The Burma Oil Co., Ltd.	Do. . .	P. L. .	2,960	24th June 1921.	1 year.
Do. .	(204) Do. . .	Do. . .	P. L. .	4,107·52	29th June 1921.	Do.
Do. .	(205) Maung Kyi .	Do. . .	P. L. . (renewal).	31·50	7th May 1921	Do.
Do. .	(206) Messrs. Burma Oil Co., Ltd.	Do. . .	P. L. .	1,158·4	17th September 1921.	Do.
Do. .	(207) Messrs. H. H. Johnson & Co.	Petroleum . .	P. L. .	1,920	22nd September 1921.	Do.
Do. .	(208) Maung Net . .	Mineral oil . .	P. L. .	100	3rd November 1921.	Do.

P. L.=*Prospecting License.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Myitkyina .	(209) Messrs. The Tavoy Tin Syndicate.	All minerals (except oil).	P. L. . (renewal)	4,800	6th August 1921	1 year.
Northern Shan States.	(210) Messrs. Frank Johnson Sons & Co.	Do. . .	P. L. .	2,560	1st August 1921.	Do.
Do. .	(211) Messrs. Hamid & Co.	Coal, copper and galena.	P. L. .	3,200	1st September 1921.	Do.
Do. .	(212) Messrs. The Coal Fields of Burma, Ltd.	All minerals (except oil).	P. L. .	3,840	1st October 1921	Do.
Pakôkku .	(213) Baijnath Singh .	Mineral oil .	P. L. .	2,400	28th March 1921	Do.
Do. .	(214) Messrs. J. A. Begbie & Co.	Do. . .	P. L. .	845	10th February 1921.	Do.
Do. .	(215) Mr. C. M. Surty .	Do. . .	P. L. .	640	11th March 1921.	Do.
Do. .	(216) Maung Po Kin .	Do. . .	P. L. .	100	16th February 1921.	Do.
Do. .	(217) Messrs. The Indo-Burma Petroleum Co., Ltd.	Do. . .	P. L. .	800	4th February 1921.	Do.
Do. .	(218) Messrs. The Indo-Burma Petroleum Co.	Do. . .	P. L. . (renewal).	2,400	17th October 1920.	Do.
Do. .	(219) Maung Maung Po	Do. . .	P. L. .	100	20th May 1921.	Do.
Do. .	(220) Baijnath Singh .	Do. . .	P. L. .	4,148·5	18th June 1921.	Do.
Do. .	(221) Ma Zan . .	Do. . .	P. L. .	100	30th June 1921.	Do.
Do. .	(222) Messrs. Frank Johnson Sons & Co., Ltd.	Do. . .	P. L. .	1,920	29th June 1921.	Do.
Do. .	(223) Do. . .	Do. . .	P. L. .	5,760	Do.	Do.
Do. .	(224) Do. . .	Do. . .	P. L. .	1,920	Do.	Do.
Do. .	(225) Messrs. Nath Singh Oil Co.	Do. . .	P. L. . (renewal).	2,240	16th May 1921.	Do.
Do. .	(226) Do. . .	Do. . .	P. L. . (renewal).	12,399·36	9th June 1921	Do.
Do. .	(227) Maung Hmon and Maung Thin.	Do. . .	P. L. .	100 Acres in width Eastern portion of demarcated block No. 14.	31st August 1921.	Do.
Do.	(228) Do. . .	Do. . .	P. L. .	320 Acres comprising Western half of block No. 70.	Do.	Do.

P. L.=*Prospecting License.*

BURMA—*contd.*

District.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Pakôkku .	(229) Mr. S. Soloman .	Mineral Oil .	P. L. . (renewal).	9,280	23rd August 1921.	2 years.
Do. .	(230) Messrs. The British Burma Petroleum Co., Ltd.	Do. . .	M. L. .	6·40	16th August 1919.	30 years.
Do. .	(231) Messrs. The Burma Oil Co., Ltd.	Do. .	M. L. .	800 (Eastern halves of blocks 15 and 16 and Eastern quarter of block 17 in the Yenangyat oil fields)	7th November 1921.	1 year.
Do. .	(232) Maung Lu Gyi Gale	Do. . .	P. L. . (renewal).	1,280 (Block 74 and area adjoining thereto in the Yenangyat oil fields).	11th August 1921.	Do.
Do. .	(233) Messrs. Indo-Burma Petroleum Co., Ltd.	Do. . .	P. L. . (renewal).	2,400 (Blocks 18, 19, 20 and 21 in the Yenangyat oil fields).	16th October 1921.	Do.
Prome .	(234) Maung Bo Ni .	Do. . .	P. L. .	46 08	22nd December 1921.	Do.
Do. .	(235) Maung Myat Thin	Do. . .	P. L. .	320	23rd December 1921.	Do.
Do. .	(236) Maung Aung Nyein	Do. . .	P. L. . (renewal).	400·00	3rd September 1921.	Do.
Do. .	(237) Ma Nyein Hla .	Do. . .	P. L. . (renewal).	123	24th August 1921.	Do.
Shwebo .	(238) Mr. M. E. Moolla	All minerals (except oil).	P. L. .	7,080	6th December 1920.	Do.
Do. .	(239) Messrs. The Indo-Burma Petroleum Co., Ltd.	Mineral oil .	P. L. .	3,232	5th November 1920.	Do.
Do. .	(240) Messrs. Frank Johnson Sons & Co., Ltd.	All minerals (except oil).	P. L. .	1,020	18th February 1921.	Do.
Do. .	(241) Mr. Ellis . .	Mineral oil .	P. L. .	2,500	23rd February 1921.	Do.
Do. .	(242) Ko Ko Gyi .	All minerals (except mineral oil).	P. L. .	640	23rd December 1920.	Do.
Do. .	(243) Messrs. The Burma Oil Co., Ltd.	Mineral oil . .	P. L. . (renewal).	7,040	8th December 1920.	2 years.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Shwebo .	(244) Messrs The Burma Oil Co. Ld.	Mineral oil .	P. L. .	4,160 and 7,993·6	19th April 1921.	1 year.
Do. .	(245) Mr. Tan Ba Thwin	Do. . .	P. L. .	100	31st March 1921.	Do.
Do. .	(246) Maung Kyaw .	Do. . .	P. L. . (renewal).	100	14th September 1921.	2 years.
Southern Shan States.	(247) Mr. C. A. Petley	All minerals (except oil).	P. L. .	1,792	7th January 1921.	1 year.
Do. .	(248) Ma Ngwe Nyun .	Do. . .	P. L. . (renewal).	320	14th June 1919.	2 years.
Do. .	(249) Maung Shwe Yin .	Do. . .	P. L. . (renewal).	80	13th December 1920.	1 year.
Do. .	(250) Maung Maung .	Do. . .	P. L. .	1,088	2nd May 1921.	Do.
Do. .	(251) U. Myaing Daw Mi & Sons.	Antimony . .	P. L. . (renewal).	160	15th October 1920.	Do.
Do. .	(252) Mr. Lim Chin Tsong.	Lead . . .	P. L. .	40	1st August 1921.	Do.
Sagaing .	(253) Ma Ma . .	Copper, silver and lead.	P. L. .	1,675·08	30th May 1921.	Do.
Do. .	(254) Do . .	All minerals (except oil).	P. L. .	2·56	20th September 1921.	Do.
Tavoy .	(255) Maung Po Swe	Do. . .	P. L. .	492	18th January 1921.	6 months.
Do. .	(256) Messrs. W. C. Toms and M. Hangan.	Do. . .	P. L. .	684	15th March 1921.	1 year.
Do. .	(257) Ong Hoe Kyin .	Do. . .	P. L. .	614	28th February 1921.	Do.
Do. .	(258) Mr. C. Wathway .	Do. . .	P. L. .	640	24th January 1921.	Do.
Do. .	(259) Md. Aslam Khan	Do. . .	P. L. .	138	25th February 1921.	6 months.
Do. .	(260) Ong Hoe Kyin .	Do. . .	P. L. . (renewal).	1,113	10th November 1920.	1 year.
Do. .	(261) Maung Maung .	Do. . .	P. L. . (renewal).	1,059	4th November 1921.	Do.
Do. .	(262) Mr. J. J. A. Page	Do. . .	P. L. . (renewal).	142	26th January 1921.	2 years.
Do. .	(263) Maung Po Myee and Maung Ni Toe.	Do. . .	P. L. . (renewal).	455	1st January 1921.	6 months.
Do. .	(264) Maung Ni Toe .	Do. . .	P. L. . (renewal).	1,385	20th January 1921.	Do.

P. L.—*Prospecting License.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Tavoy .	(265) Ma Thaw . .	All minerals (except oil).	P. L. . (renewal).	636	28th February 1921.	1 year.
Do. .	(266) Quah Cheng Guan	Do. . .	P. L. .	253	25th April 1921.	Do.
Do. .	(267) Mr. R. C. N. Twite	Do. . .	P. L. .	574	13th June 1921.	6 months.
Do. .	(268) Messrs. J. A. Ali Bros.	Do. . .	P. L. .	236	30th May 1921.	1 year.
Do. .	(269) Mr. T. Fowle .	Do. . .	P. L. .	307	4th May 1921	Do.
Do. .	(270) Maung Ni Toe .	Do. . .	M. L. .	1,104·08	26th September 1917.	30 years.
Do. .	(271) Mr. G. Lovell .	Do. . .	P. L. . (renewal).	476	20th November 1920.	2½ years. (The original P. L. being for 6 months only).
Do. .	(272) Mr. R. C. N. Twite	Do. . .	P. L. . (renewal).	358	1st January 1921.	6 months.
Do. .	(273) Khoo Tun Byan .	Do. . .	P. L. . (renewal).	558	23rd January 1921.	1 year.
Do. .	(274) Mr. E. M. Lefroy	Do. . .	P. L. . (renewal).	369	1st June 1921	Do.
Do. .	(275) Messrs. The Indo-Burma Tin Corporation, Ltd.	Coal . . .	P. L. .	753	1st June 1921	Do.
Do. .	(276) Messrs. The Indo-Tin Corporation, Ltd.	Tin . . .	P. L. .	4	20th September 1921.	Do.
Do. .	(277) Mr. W. C. Toms .	All minerals (except oil).	P. L. .	240	8th August 1921.	Do.
Do. .	(278) Mr. M. Manekji .	Coal . . .	P. L. .	1,833	30th August 1921.	Do.
Do. .	(279) Mr. R. C. N. Twite	All minerals (except oil).	P. L. .	389	13th August 1921.	6 months.
Do. .	(280) Maung Maung .	Do. . .	P. L. .	287	22nd July 1921.	1 year.
Do. .	(281) Mr. J. J. A. Page	Do. . .	P. L. .	338	21st July 1921..	Do.
Do. .	(282) Ong Hoe Kyin .	Do. .	M. L. .	237·27	13th June 1919.	30 years.
Do. .	(283) Ma Ma. . .	Do. .	M. L. .	46·88	23rd February 1919	Do.
Do. .	(284) Messrs. Tata Sons, Ltd.	Do. .	P. L. (renewal.)	595	1st April 1921.	1 year.
Do. .	(285) Messrs. Bulloch Bros. & Co., Ltd.	Do. .	P. L. (renewal.)	640	18th June 1921.	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Tavoy .	(286) Ma Yai . .	All minerals (except oil.)	P. L. (renewal.)	610	8th May 1921.	1 year.
Do. .	(287) Messrs. Tha Dun U Bros.	Do. .	P. L. (renewal.)	1,088	9th June 1921.	Do.
Do. .	(288) Do.	Do.	P. L. (renewal.	1,260	15th June 1921.	Do.
Do. .	(289) Mr. R. C. N. Twite	Do. .	P. L. (renewal.)	358	1st July 1921	Do.
Do. .	(290) Maung Po Myee and Maung Ni Toe.	Do. .	P. L. (renewal.)	296	1st July 1921	Do.
Do. .	(291) Maung Ni Toe .	Do. .	P. L. (renewal.)	307	20th July 1921.	Do.
Do. .	(292) Eu Shwe Swai .	Do. .	P. L. (renewal.)	612	1st July 1921.	Do.
Do. .	(293) C. Soo Don .	Do. .	P. L. (renewal.)	1,092	1st July 1921.	Do.
Do. .	(294) Maung Po Swe .	Do. .	P. L. (renewal.)	492	18th July 1921.	Do.
Do. .	(295) Mahomed Aslam Khan.	Do. .	P. L. (renewal.)	138	25th August 1921.	Do.
Do. .	(296) Maung Ba Oh .	Do. .	P. L. (renewal.)	2,340	7th October 1921.	Do.
Do. .	(297) Mr. J. M. Manekji	Do. .	P. L. .	1,106	27th October 1921.	Do.
Do. .	(298) Messrs. Steel Bros. & Co., Ltd.	Do. .	M. L. .	801·14	19th July 1917.	30 years.
Do. .	(299) Messrs. The High Speed Steel Alloys Mining Co., Ltd.	Do. .	M. L. .	2,105·86	20th April 1917.	Do.
Do. .	(300) Messrs. The London and Burmese Wolfram Co., Ltd.	Do. .	M. L. .	2,103·61	15th March 1918.	Do.
Do. .	(301) Messrs. The Bombay Burmah Trading Corporation, Ltd.	Do. .	M. L. (dredging lease.)	250·91	2nd February 1920.	15 years.
Do. .	(302) Maung Me . .	Do. .	P. L. (renewal.)	640	1st September 1921.	1 year.
Do. .	(303) C. Wa Thway .	Do. .	P. L. (renewal.)	1,247	1st September 1921.	9 months.
Do. .	(304) Maung Maung .	Do. .	P. L. (renewal.)	2,048	1st October 1921.	1 year.
Do. .	(305) Do.	Do. .	P. L. (renewal.)	256	20th October 1921.	6 months.
Do. .	(306) Do. .	Do. .	P. L. (renewal.)	1,059	4th November 1921.	1 year.

P. L. = *Prospecting License* M. L. = *Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Thaton .	(307) Messrs. T. D'Castro & Son.	All minerals (except oil.)	P. L. .	396·8	21st March 1921.	1 year.
Do. .	(308) Ma Lon . .	Do. .	P. L. .	1,120	28th February 1921.	Do.
Do. .	(309) Maung Tha Dun .	Do. .	P. L. .	1,171·2	5th April 1921.	Do.
Do. .	(310) Mr. A. J. Argent	Do. .	P. L. .	819·2	4th April 1921.	Do.
Do. .	(311) Maung Pu . .	Do. .	P. L. .	1,260·8	10th September 1921.	Do.
Do. .	(312) Ma Bwa . .	Do. .	P. L. . (renewal.)	2,060·8	20th September 1921.	Do.
Thayetmyo	(313) Maung Tun Aung Gyaw.	Mineral oil .	P. L. .	100	18th May 1921.	Do.
Do. .	(314) Messrs. Indo-Burma Oil-fields (1920), Ltd.	Do. . .	P. L. .	2,560	12th July 1921.	Do.
Do. .	(315) Messrs. The Coal-fields of Burma, Ltd.	Coal . . .	P. L. .	960	6th August 1921.	Do.
Do. .	(316) Messrs. The Indo-Burma Oil-fields (1920), Ltd.	Mineral oil .	P. L. .	11,840	23rd July 1921.	Do.
Do. .	(317) Do.	Do. .	P. L. . (renewal.)	6,080	17th August 1921.	Do.
Do. .	(318) Do. .	Do. .	P. L. . (renewal.)	4,800	6th October 1921.	Do.
Toungoo .	(319) Maung Maung .	All minerals (except oil)	P. L. . (renewal.)	148·48	27th January 1921.	Do.
Upper Chindwin.	(320) Messrs. Frank Johnson Sons & Co., Ltd.	Mineral oil and Coal.	P. L. .	1,824	7th February 1921.	Do.
Do.	(321) Mr. W. R. Smith	Gold . . .	P. L. .	2,400	11th April 1921.	Do.
Do.	(322) Messrs. The Indo-Burma Petroleum Co., Ltd.	Mineral oil .	P. L. .	3,840	16th May 1921.	Do.
Do.	(323) S. Solomon .	Do. .	P. L. . (renewal).	2,560	29th April 1921.	Do.
Do. .	(324) Do. .	Do. .	P. L. . (renewal.)	3,200	24th May 1921.	Do.
Do.	(325) Messrs. The Indo Burma Petroleum Co., Ltd.		P. .	2,560	12th February 1921.	Do.
Do. .	(326) Sir Abdul Karim Jamal, Kt., C.I.E.	All minerals (except oil.)	P. L. .	2,560	22nd December 1920.	Do.
Do. .	(327) Messrs. The Indo-Burma Petroleum Co., Ltd.	Mineral oil .	P. L. .	12,800	12th November 1920.	Do.

P. L.=*Prospecting License.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Upper Chindwin.	(328) Mr. W. R. Smith	Gold and associated minerals.	P. L.	608	5th August 1921.	1 year.
Do.	(329) Do.	Do.	P. L.	1,280	Do.	Do.
Do.	(330) The Burma Finance and Mining Co., Ltd.	All minerals including mineral oil.	P. L.	8,736	8th September 1921.	Do.
Do.	(331) The Coal-fields of Burma, Ltd., Rangoon.	Coal	P. L.	1,632	15th September 1921.	Do.
Do.	(332) Do.	Do.	P. L.	2,188·8	31st August 1921.	Do.
Do.	(333) Messrs. Frank Johnson Sons & Co., Ltd.	Mineral oil	P. L.	6,176	5th October 1921.	Do.
Do.	(334) Messrs. The Coal-fields of Burma, Ltd.	Coal	P. L.	10,284·8	26th November 1921.	Do.
Do.	(335) Messrs. Frank Johnson Sons & Co., Ltd.	Mineral oil	P. L.	3,078·4	26th October 1921.	Do.
Yamethin	(336) Messrs. Hajee Abdul Shakoor Hajee Cassim & Sons.	All minerals (except oil.)	P. L.	518·4	29th January 1921.	Do.
Do.	(337) Mr. B. R. Fernandez.	Do.	P. L.	3,392	20th December 1920.	Do.
Do.	(338) Messrs. Hajee Abdul Shakoor Hajee Kasim & Sons.	Do.	P. L. (renewal.)	1,779·2	7th January 1921.	Do.

CENTRAL PROVINCES.

Balaghat	(339) Messrs. Tata Sons, Ltd.	Bauxite	P. L. (renewal.)	533	1st February 1921.	1 year.
Do.	(340) Do.	Do.	P. L. (renewal.)	525	Do.	Do.
Do.	(341) Do.	Do.	P. L. (renewal.)	65	Do.	Do.
Do.	(342) Do.	Do.	P. L. (renewal.)	20	Do.	Do.
Do.	(343) Do.	Do.	P. L. (renewal.)	267	Do.	Do.
Do.	(344) Do.	Do.	P. L. (renewal.)	151	Do.	Do.
Do.	(345) Do.	Do.	P. L. (renewal.)	116	Do.	Do.
Do.	(346) Do.	Do.	P. L. (renewal.)	64	Do.	Do.

P. L.—*Prospecting License.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(347) Messrs. Tata Sons, Ltd.	Bauxite . .	P. L. . (renewal.)	93	1st February 1921.	1 year.
Do. .	(348) Do. .	Do. . .	P. L. . (renewal.)	96	31st December 1920.	Do.
Do. .	(349) Do. .	Do . .	P. L. . (renewal.)	68	Do. .	Do.
Do. .	(350) Do. .	Do. . .	P. L. . (renewal.)	107	Do. .	Do.
Do. .	(351) Pandit Rewashanker.	Manganese . .	M. L. .	75	9th February 1921.	10 years.
Do. .	(352) Do. .	Do. . .	P. L. .	31	11th February 1921.	1 year.
Do. .	(353) Seth Gowardhan Das.	Do. . .	M. L. .	28	6th January 1921.	15 years.
Do. .	(354) Do. .	Do. . .	M. L. .	19	3rd January 1921.	5 years.
Do. .	(355) Do. .	Do. . .	P. L. .	2	9th March 1921.	1 year.
Do. .	(356) Mr. C. S. Harris .	Do. . .	M. L. .	14	4th January 1921.	30 years.
Do. .	(357) Do. .	Do. . .	P. L. .	6	14th March 1921.	1 year.
Do. .	(358) Seth Shriram .	Do. . .	M. L. .	58	6th March 1921.	30 years.
Do. .	(359) Central India Mining Company, Ltd.	Do. .	P. L. .	99	10th March 1921.	1 year.
Do. .	(360) Mr. Balkrishna Narayan Soparkar.	Do.	P. L. .	77	16th February 1921.	1 year.
Do. .	(361) Do. .	Do. .	P. L. .	450	Do. .	Do.
Do. .	(362) Do. .	Do. .	P. L. .	133	Do. .	Do.
Do. .	(363) Do. .	Do. . .	P. L. .	278	Do. .	Do.
Do. .	(364) Rai Sahib Chajjooram.	Do. . .	P. L. .	102	29th January 1921.	Do.
Do. .	(365) Do. .	Do. . .	P. L. .	22	19th February 1921.	Do.
Do. .	(366) Do. .	Do. .	P. L. .	46	22nd February 1921	Do.
Do. .	(367) Pandit Rewashanker.	Do. . .	P. L. .	38	6th April 1921.	Do.
Do. .	(368) Do. .	Do. . .	P. L. .	23	21st May 1921.	Do.
Do. .	(369) Seth Shriram .	Do. . .	P. L. .	56	8th May 1921	Do.
Do. .	(370) Do. .	Do. . .	P. L. .	13	Do. .	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

CENTRAL PROVINCES—*contd.*

District.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(371) Indian Manganese Co, Ltd.	Manganese .	P. L. .	392	22nd June 1921.	1 year.
Do. .	(372) Central India Mining Co., Ltd.	Do. . .	P. L. .	753	20th May 1921.	Do.
Do. .	(373) Do. .	Do. . .	P. L. .	34	15th May 1921.	Do.
Do. .	(374) Mr M. A. Pasha, minor, guardian Shaikh Alimuddin.	Do. . .	P. L. .	741	17th May 1921.	Do.
Do. .	(375) Pandit Kripashanker.	Do. . .	P. L. .	129	21st May 1921.	Do.
Do. .	(376) Do. .	Do. . .	M. L. .	57	17th May 1921.	15 years.
Do. .	(377) Seth Mahanandram Sheonarayan.	Do. . .	P. L. .	12	22nd May 1921.	1 year.
Do. .	(378) Seth Gowardhandas	Do. . .	P. L. .	52	28th May 1921.	Do.
Do. .	(379) Mr. C. S. Harris .	Do. . .	M. L. .	9	5th May 1921	30 years.
Do. .	(380) Messrs. Tata Sons, Ltd.	Bauxite . .	P. L. . (renewal.)	38	5th November 1921.	2 years.
Do. .	(381) Do. .	Do. . .	P. L. . (renewal.)	54	Do. .	Do.
Do. .	(382) Do. .	Do. . .	P. L. . (renewal.)	1,606	Do. .	Do.
Do. .	(383) Do. .	Do. . .	P. L. . (renewal.)	238	Do. .	Do.
Do. .	(384) Do. .	Do. . .	P. L. . (renewal.)	902	Do.	Do.
Do. .	(385) Pandit Rewashanker.	Manganese . .	M. L. .	69	1st July 1921	15 years.
Do. .	(386) Do. .	Do. . .	M. L. .	39	28th September 1921.	20 years.
Do. .	(387) Do. .	Do. . .	P. L. .	84	8th July 1921.	1 year.
Do. .	(388) Pandit Kripashanker	Do. . .	M. L. .	173	4th July 1921.	15 years.
Do. .	(389) Netra Manganese Co., Ltd.	Do. . .	P. L. .	216	8th July 1921.	1 year.
Do. .	(390) Mr. M. A. Pasha, minor, guardian Shaikh Alimuddin.	Do. . .	P. L. .	532	5th July 1921.	Do.
Do. .	(391) Mr. Sunderlal Golcha	Do. . .	P. L. .	10	8th July 1921.	Do.
Do. .	(392) Do. .	Do. . .	P. L. .	14	31st August 1921.	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(393) Mr. Sunderlal Golcha.	Manganese . .	P. L. .	145	2nd September 1921.	1 year.
Do. .	(394) . Do. .	Do. . .	P. L. .	210	26th September 1921.	Do.
Do. .	(395) Mr. C. S. Harris .	Do. . .	M. L. .	3	15th August 1921.	5 years.
Do. .	(396) Do. .	Do. . .	M. L. .	30	9th August 1921.	30 years.
Do. .	(397) Rai Bahadur Bansilal Abirchand Mining Syndicate.	Copper . .	P. L. .	533	31st August 1921.	1 year.
Do. .	(398) Mr. Balkrishna Narain Soparkar.	Manganese . .	P. L. .	19	Do. .	Do.
Do. .	(399) Do. .	Do. . .	P. L. .	36	26th September 1921.	Do.
Do. .	(400) Do. .	Do. . .	P. L. .	95	27th September 1921.	Do.
Do. .	(401) Pandit Kripashanker of Balaghat.	Do. . .	M. L. .	50·43	22nd October 1921.	10 years.
Do. .	(402) Do. .	Do. . .	M. L. .	39·00	12th December 1921.	Do.
Do. .	(403) Messrs. Tata Sons, Ltd.	Bauxite . .	P. L. . (renewal.)	386·99	13th December 1921.	1 year.
Do. .	(404) Do. .	Do. . .	P. L. . (renewal.)	213·95	Do. .	Do.
Do. .	(405) Do. .	Do. . .	P. L. . (renewal.)	322·01	Do. .	Do.
Do. .	(406) Messrs. Martin & Co.	Manganese . .	P. L. . (renewal.)	14·06	16th December 1921.	Do.
Do. .	(407) Do. .	Do. . .	P. L. . (renewal.)	14·39	16th December 1921.	Do.
Do. .	(408) Do. .	Do. . .	P. L. . (renewal.)	108·14	Do. .	Do.
Do. .	(409) Pandit Rewashanker of Balaghat.	Do. . .	P. L. .	80·00	3rd October 1921.	Do.
o.	(410) Mr. Balkrishna Narayan Soparkar.	Do. . .	P. L. .	23·33	19th December 1921.	Do.
Do. .	(411) Do. .	Do. . .	P. L . .	42·84	Do. .	Do.
Do. .	(412) Do. .	Do. .	P. L. .	131·57	Do. .	Do.
Do. .	(413) R. S. B. Chajjooram.	Do. . .	P. L. .	14·19	10th October 1921.	Do.
Do. .	(414) Do. .	Do. . .	P. L. .	34·35	Do. .	Do.
Do. .	(415) Do. .	Do. . .	P. L. .	13·39	Do. .	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(416) K. B. B. P. Byramji & Co.	Manganese . .	M. L. .	1·40	9th November 1921.	5 years.
Do. .	(417) Mr. Bakaram Singh	Do. . .	P. L. .	106·67	17th November 1921.	1 year.
Do. .	(418) The Central India Mining Company, Ltd.	Do. . .	M. L. .	·62	26th November 1921.	2 years.
Do. .	(419) Mr. M. A. Pasha, minor, guardian Munshi Alimuddin.	Do. . .	P. L. .	347·00	3rd October 1921.	1 year.
Do. .	(420) Do. .	Do. . .	P. L. .	29·90	Do. .	Do.
Do. .	(421) Seth Shriram .	Do. . .	M. L. .	1·28	4th October 1921.	30 years.
Do. .	(422) Do. .	Do. . .	M. L. .	107·00	22nd December 1921.	10 years.
Do. .	(423) Do. .	Do. . .	M. L. .	·55	4th October 1921.	30 years.
Do. .	(424) Do. .	Do. . .	M. L. .	34 00	22nd December 1921.	5 years.
Do. .	(425) Do. .	Do. . .	M. L. .	14·05	26th October 1921.	3 years.
Do. .	(426) Mr. Balkrishna Narain Soparkar.	Do. . .	M. L. .	243·84	8th December 1921.	30 years.
Do. .	(427) Do. .	Do. . .	P. L. .	336·08	30th November 1921.	1 year.
Do. .	(428) Do. .	Do. . .	P. L. .	12·25	10th October 1921.	Do.
Do. .	(429) Do. .	Do. . .	P L. .	92·51	24th October 1921.	Do.
Do. .	(430) Do. .	Do. . .	P. L. .	22·43	17th November 1921.	Do
Do. .	(431) Do. .	Do. . .	P. L. .	21·25	Do. .	Do.
Do. .	(432) Do. .	Do. . .	P. L. .	19·00	19th December 1921.	Do.
Betul .	(433) Mr. R. Bazaj .	Coal . . .	P. L. .	840	19th January 1921.	Do.
Do. .	(434) Shaikh Shahabuddin.	Ferric oxide (ochre)	P. L .	635	21st May 1921.	Do.
Do. .	(435) Rai Sahib Chhajjuram.	Coal . . .	P. L. .	331	6th June 1921.	Do.
Do. .	(436) Do. .	Do. . . .	P. L. .	97	6th June 1921.	Do.
Do. .	(437) Do. .	Do. . . .	P. L. .	113	Do.	Do.
Do. .	(438) Mr. R. Bazaj .	Do. . . .	M. L. .	2,419	8th September 1921.	30 years.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

CENTRAL PROVINCES—*contd.*

District.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Betul .	(439) Mr. R. Baraj .	Coal . . .	M. L. .	2,813	28th July 1921.	30 years.
Do. .	(440) Messrs. Nabibux Inayatullah.	Manganese, Iron and Ferric oxide.	P. L. .	1,059·01	9th December 1921.	1 year.
Do. .	(441) Banshidhar Ramniwas.	Coal . . .	P. L. .	798·11	18th November 1921.	Do.
Do. .	(442) Jagannath Bisheshwarlal.	Do. . .	P. L. .	937·45	27th October 1921.	Do.
Bhandara .	(443) Messrs. Lalbehari Narayandas and Ramcharan Shankerlal.	Manganese .	M. L. .	30	23rd May 1921.	20 years.
Do. .	(444) Seth Shriram .	Do. . .	P. L. .	3	29th June 1921.	1 year.
Do .	(445) Rai Sahib Seth Gowardhan Dass.	Do. . .	M. L. .	20·30	18th November 1921.	10 years.
Do. .	(446) Seth Shriram .	Do. . .	M. L. .	27	20th August 1921.	30 years.
Bilaspur .	(447) Messrs. Chari & Co., Ltd.	Coal . . .	P. L. .	1,630	18th January 1921.	1 year.
Chanda .	(448) Mr. H. Verma and Munshi Kanhaiyalal.	Galena . .	P. L. .	614	14th April 1921.	Do.
Do. .	(449) Rao Sahib D. Lakshminarayan.	Coal . . .	P. L. .	179	2nd May 1921.	Do.
Do. .	(450) Do. .	Do. . . .	P. L. .	93	20th May 1921.	Do.
Do. .	(451) Messrs. Hajibhai Lalji & Co.	Do. . . .	M. L. .	981	22nd July 1921.	30 years.
Do. .	(452) Messrs. Martin & Co.	Manganese . .	P. L. .	709	20th July 1921.	1 year.
Do. .	(453) Messrs. T. F. Karaka & Co.	Iron . . .	P. L. .	472	4th August 1921.	Do.
Do. .	(454) Do. .	Do. . . .	P. L. .	272	17th August 1921.	Do.
Do. .	(455) Rao Sahib Mathura Prasad Motilal & Co.	Coal . . .	P. L. .	461	16th November 1921.	Do.
Do. .	(456) Rao Sahib D. Laxmi Narayan of Kamptee.	Do. . . .	P. L. .	1,334·81	18th November 1921.	Do.
Do. .	(457) Do. .	Do. . . .	P. L. .	1,858·80	Do. .	Do.
Do. .	(458) Do. .	Do. . . .	P. L. .	996·33	Do. .	Do.
Chhindwara.	(459) Indian Manganese Co.	Manganese . .	P. L.	79	7th January 1921.	Do.
Do. .	(460) Do. .	Do. . .	P. L. .	182	Do. .	Do.
Do. .	(461) Pandit Kripashanker.	Coal . . .	P. L. .	203	22nd March 1920.	Do.
Do. .	(462) Mr. R. Bazaj .	Do. . . .	M. L. .	571	21st June 1921.	30 years.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Chhindwara	(463) Mr. B. V. Buti	Coal	P. L.	589	30th April 1921.	1 year.
Do.	(464) Mr. R. Bazaj	Do.	P. L.	495	25th April 1921.	Do.
Do.	(465) Mr. B. V. Buti	Do.	P. L.	74	30th April 1921.	Do.
Do.	(466) Seth Lakshmichand of Seoni.	Do.	P. L.	229	15th June 1922.	Do.
Do.	(467) Do.	Do.	P. L.	333	31st May 1921.	Do.
Do.	(468) Mr. A. H. Wasudeo Rao.	Do.	P. L.	48	21st May 1921.	Do.
Do.	(469) Shaikh Shahabuddin.	Do.	P. L.	263	18th May 1921.	Do.
Do.	(470) Seth Jagannath	Do.	P. L.	133	19th April 1921.	Do.
Do.	(471) Rai Sahib Sunderlal	Do.	P. L.	358	6th May 1922	Do.
Do.	(472) Seth Gowardhandas	Do.	P. L.	243	29th April 1921.	Do.
Do.	(473) Do.	Do.	P. L.	236	3rd June 1921.	Do.
Do.	(474) Do.	Do.	P. L.	463	11th May 1921.	Do.
Do.	(475) Rai Sahib Chhajjuram.	Manganese	P. L.	235	2nd June 1921.	Do.
Do.	(476) Do.	Do.	P. L.	138	Do.	Do.
Do.	(477) Seth Lakshmichand of Betul.	Coal	P. L.	573	9th May 1921	Do.
Do.	(478) Seth Lakshmichand of Seoni.	Do.	P. L.	255	18th May 1921.	Do.
Do.	(479) Pandit Kripashanker.	Do.	P. L.	184	9th June 1921	Do.
Do.	(480) Do.	Do.	P. L.	48	28th May 1921.	Do.
Do.	(481) Rai Sahib Sunderlal	Do.	P. L.	213	6th May 1921	Do.
Do.	(482) Do.	Do.	P. L.	396	14th May 1921.	Do.
Do.	(483) Seth Lakshmichand of Betul.	Do.	P. L.	142	9th May 1921	Do.
Do.	(484) Rai Sahib Sunderlal	Do.	P. L.	84	14th May 1921.	Do.
Do.	(485) Do.	Do.	P. L.	178	5th May 1921	Do.
Do.	(486) Do.	Do.	P. L.	15	Do.	Do.

P. L.=*Prospecting License.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Chhindwara	(487) Rai Sahib Sunderlal	Coal . . .	P. L. .	182	15th June 1921.	2 years.
Do. .	(488) Rai Sahib Hiralal Verma and Munshi Kanhaiyalal.	Do. . . .	P. L. .	624	29th September 1921.	1 year.
Do. .	Sir M. B. Dadabhoy .	Manganese .	P. L. .	103	21st July 1921.	Do.
Do. .	(490) Mr. B. V. Buti .	Coal . .	P. L. .	88	7th September 1921.	Do.
Do. .	(491) Do. .	Do . . .	P. L. .	195	Do. .	Do.
Do.	(492) Shaikh Shahabuddin.	Do. . . .	P. L. .	359	16th July 1921.	Do.
Do. .	(493) Mr. M. V. Kaorey	Manganese . .	P. L. .	48	6th September 1921.	Do.
Do. .	(494) Seth Jagannath .	Coal . . .	P. L. .	139	7th July 1921.	Do.
Do. .	(495) Do. .	Do. . . .	P. L. .	215	22nd August 1921.	Do.
Do. .	(496) Do. .	Do. . . .	P. L. .	204	7th July 1921.	Do.
Do. .	(497) Do. .	Do. . . .	P. L. .	244	10th July 1921.	Do.
Do. .	(498) Seth Lakshmichand of Betul.	Do. . . .	P. L. .	1,127	3rd August 1921.	Do.
Do. .	(499) Pandit Kripashanker.	Do. . . .	P. L. .	105	8th September 1921.	Do.
Do. .	(500) Do. .	Do. . . .	P. L. .	192	Do. .	Do.
Do. .	(501) Do. .	Do. . . .	P. L. .	421	Do. .	Do.
Do. .	(502) Seth Lakshmichand of Betul.	Do. . . .	P. L. .	586	16th September 1921.	Do.
Do. .	(503) Rai Sahib Sunderlal.	Do. . . .	P. L. .	616	25th July 1921	Do.
Do. .	(504) Seth Gowardhandas.	Do. . . .	P. L. .	222	3rd September 1921.	Do.
Do. .	(505) Seth Lakshmichand of Betul.	Do. . . .	P. L. .	119	22nd September 1921.	Do.
Do. .	(506) Pandit Kripashankar.	Do. . . .	P. L. .	338	8th September 1921.	Do.
Do. .	(507) Seth Lakshmichand of Seoni.	Do. . . .	P. L. .	66	25th August 1921.	Do.
Do. .	(508) Do. . .	Do. . . .	P. L. .	637	25th August 1921.	Do.
Do. .	(509) Rai Sahib Minnamal and Nandlal.	Do. . . .	P. L. .	324	21st July 1921.	Do.

P. L.—*Prospecting License.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Chhindwara	(510) Seth Beharilal .	Coal . . .	P. L. .	210	17th August 1921.	1 year.
Do. .	(511) Do. . .	Do. . . .	P. L. .	92	17th September 1921.	Do.
Do. .	(512) Messrs. Maharaj Kishan & Co.	Do. . . .	P. L. .	204	6th September 1921.	Do.
Do. .	(513) Seth Beharilal .	Do. . . .	P. L. .	68	10th September 1921.	Do.
Do. .	(514) Do. . .	Do. . . .	P. L. .	199	21st September 1921.	Do.
Do. .	(515) Khan Sahib Mulla Hassanji & Sons.	Do. . . .	P. L. .	194	24th September 1921.	Do.
Do. .	(516) Seth Naraindas .	Manganese . .	P. L. .	64	16th August 1921.	Do.
Do. .	(517) Mr. B. V. Buti .	Coal . . .	P. L. .	175·00	28th November 1921.	Do.
Do. .	(518) Messrs. H. Verma and Munshi Kanhaylal.	Do. . . .	P. L. .	318·31	3rd December 1921.	Do.
Do. .	(519) Seth Jagannath Tumsar.	Do. . . .	P. L. .	115·20	15th October 1921.	Do.
Do. .	(520) Rai Sahib Sunderlal.	Do. . . .	P. L. .	467·00	10th November 1921.	Do.
Do. .	(521) Messrs. B. P. Byramji & Co., Nagpur.	Do. . . .	P. L. .	177·58	15th November 1921.	Do.
Do. .	(522) Seth Jagannath .	Do. . . .	P. L. .	97·76	27th October 1921	Do.
Do. .	(523) Seth Goverdhandas	Do. . . .	P. L. .	151·20	19th October 1921.	Do.
Do. .	(524) Seth Jagannath .	Do. . . .	P. L. .	87·78	27th October 1921.	Do.
Do. .	(525) Pandit Kripashanker.	Do. . . .	P. L. .	336·00	1st December 1921.	Do.
Do. .	(526) Hazi Fazal & Sons	Manganese . .	P. L. .	60·78	19th December 1921.	Do.
Do. .	(527) Do. . .	Do. . .	P. L. .	31·22	Do. .	Do.
Do. .	(528) Seth Minamal and Nandlal.	Do. . .	P. L. .	677·49	12th October 1921.	Do.
Do. .	(529) Seth Narayandas .	Do. . .	P. L. .	65·00	4th November 1921.	Do.
Do. .	(530) Messrs. M. L. Bharadwaj.	Do. . .	P. L. .	249·05	9th December 1921.	Do.
Do. .	(531) M. Hasanji & Sons	Do. . .	P. L. .	186·00	27th October 1921.	Do.
Do. .	(532) Messrs. Maharaj Kishan & Co.	Do. . .	P. L. .	52·49	25th November 1921.	Do.

P. L. = *Prospecting License.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Chhindwara	(533) Messrs. M. L. Bharadwaj & Co.	Manganese . .	P. L. .	199·88	18th October 1921.	1 year.
Do. .	(534) Khan Sahib M. Hasanji & Sons.	Do. . .	P. L. .	475·41	27th October 1921.	Do.
Do. .	(535) Do. . .	Coal . . .	P. L. .	200·94	Do. .	Do.
Do. .	(536) Messrs. Bharadwaj & Co.	Do. . . .	P. L. .	166·5	18th October 1921.	Do.
Do. .	(537) Do. . .	Do. . . .	P. L. .	75·41	28th November 1921	Do.
Do. .	(538) Lala Beharilal .	Do. . . .	P. L. .	159·33	8th October 1921.	Do.
Do. .	(539) Do. . .	Do. . . .	P. L. .	178·18	Do. .	Do.
Do. .	(540) Seth Girdharilal .	Do. . . .	P. L. .	147·37	17th October 1921.	Do.
Do. .	(541) Do. . .	Do. . . .	P. L. .	165·47	16th November 1921.	Do.
Do. .	(542) Messrs. M. L. Bharadwaj & Co.	Do. . . .	P. L. .	95·82	23rd December 1921.	Do.
Do. .	(543) Laxmichand, Betul	Do. . . .	P. L. .	84·00	21st December 1921.	Do.
Do. .	(544) Seth Girdharilal .	Do. . . .	P. L. .	187·20	16th November 1921.	Do.
Do. .	(545) Do. . .	Do. . . .	P. L. .	234·50	28th November 1921.	Do.
Do. .	(546) Messrs. Maharaj Kishan & Co	Do. . . .	P. L. .	544·13	16th December 1921.	Do.
Do.	(547) Seth Girdharilal .	Do. . . .	P. L. .	200·47	21st October 1921.	Do.
Do. .	(548) Do. . .	Do. . . .	P. L. .	129·61	16th November 1921.	Do.
Do. .	(549) Do. . .	Do. . . .	P. L. .	220·69	8th November 1921.	Do.
Do. .	(550) Pandit Thakur Prasad.	Do. . . .	P. L. .	127·85	19th December 1921.	Do.
Do. .	(551) Seth Girdharilal .	Do. . . .	P. L. .	284·57	16th November 1921.	Do.
Do. .	(552) Seth Sheolal, M.L.C.	Do. . . .	P. L. .	605·35	12th December 1921.	Do.
Do. .	(553) Messrs. Bharadwaj and others.	Do. . . .	P. L. .	95·00	23rd December 1921.	Do.
Do. .	(554) Seth Sheolal, M.L.C.	Do. . . .	P. L. .	106·08	Do. .	Do.
Do. .	(555) Messrs. Bharadwaj & Co.	Do. . . .	P. L. .	62·53	..	Do.

P. L.=*Prospecting License.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Chhindwara	(556) Seth Sheolal .	Coal . . .	P. L. .	158·74	23rd December 1921.	1 year.
Do. .	(557) A. H. Wasudeo Rao.	Do. . . .	M. L. .	25·64	29th November 1921.	30 years.
Jubbulpore	(558) Messrs. Grandage Moir & Co.	Bauxite . .	P. L. .	252	5th April 1921.	1 year.
Do. .	(559) Do. . .	Do. . .	P. L. .	27	Do. .	Do.
Do. .	(560) Mr. George Forrester.	Do. . .	P. L. .	216	5th July 1921.	Do.
Nagpur .	(561) Gosai Ramkrishnapuri.	Manganese . .	P. L. .	20	16th March 1921.	Do.
Do. .	(562) Mir Aslam Khan .	Do. . .	P. L. .	70	7th January 1921.	Do.
Do. .	(563) Do. . .	Do. . .	M. L. .	108	3rd January 1921.	10 years.
Do. .	(564) Do. . .	Do. . .	P. L. .	268	8th February 1921.	1 year.
Do. .	(565) Central India Mining Co., Ltd.	Do. . .	M. L. .	6	11th January 1921.	Will expire with the mining lease, dated the 7th February 1906, to which it is supplementary.
Do. .	(566) Indian Manganese Co.	Do. . .	P. L. .	420	2nd March 1921.	1 year.
Do. .	(567) Do. . .	Do. . .	P. L. .	135	2nd March 1921.	Do.
Do. .	(568) Mr. C. S. Harris .	Do. . .	P. L. .	181	10th June 1921.	Do.
Do. .	(569) Mir Aslam Khan .	Do. . .	P. L. .	61	1st June 1921	Do.
Do. .	(570) Gosain Ramkrishnapuri.	Do. . .	P. L. .	709	18th May 1921.	Do.
Do. .	(571) Do. . .	Do. . .	M. L. .	6	2nd May 1921	30 years.
Do. .	(572) Do. . .	Do. . .	M. L. .	4	Do. .	Do.
Do. .	(573) Do. . .	Do. . .	P. L. .	52	13th June 1921	1 year.
Do. .	(574) Mr. M. V. Kaorey	Do. . .	P. L. .	61	27th June 1921.	Do.
Do. .	(575) Do. . .	Do. . .	P. L. .	72	27th June 1921.	Do.
Do. .	(576) Rao Sahib D. Lakshmi Naryan.	Do. . .	P. L. .	26	25th May 1921.	Do.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

CENTRAL PROVINCES—*concld.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Nagpur .	(577) Messrs. Goredutta Ganeshlal and M. D'Costa.	Manganese .	P. L. .	99	19th May 1921.	1 year.
Do. .	(578) Mr. Laxman Damodhar Lele.	Do. . .	M. L. .	14	16th August 1921.	30 years.
Do. .	(579) Messrs. Lalbehari Narayandas and Ramcharan Shankerlal.	Do. . .	M. L. .	20	26th August 1921.	5 years.
Do. .	(580) Seth Mahanandram Sheonarayan.	Do. . .	P. L. .	85	17th September 1921.	1 year.
Do. .	(581) The Central India Mining Co.	Do. . .	P. L. .	89	31st August 1921.	Do.
Do. .	(582) Rai Sahib Ramkrishna Puri Gosai of Nagpur.	Do. . .	P. L. .	166·94	5th November 1921.	Do.
Do. .	(583) Do. . .	Do. . .	P. L. .	103·73	Do. .	Do.
Do. .	(584) Do. . .	Do. . .	P. L. .	31·78	Do. .	Do.
Do. .	(585) Mr. Balkrishna Narayan Soparkar of Balaghat.	Do. . .	P. L. .	43·17	Do. .	Do.
Do. .	(586) Seth Mahanandram Sheonarayan of Kamptee.	Do. . .	P. L. .	28·55	22nd December 1921.	Do.
Do. .	(587) Mr. Ganpat Rao Laxman of Nagpur.	Wolfram and Galena.	P. L. .	185·03	23rd November 1921.	Do.
Do. .	(588) Mir Aslam Khan of Nagpur.	Manganese . .	P. L. .	6·16	8th December 1921.	Do.
Do. .	(589) Mir Aslam Khan .	Do. . .	P. L. .	30·66	Do. .	Do.
Do. .	(590) Mr. Shamji Narayanji of Kamptee.	Do. .	P. L. .	19·76	22nd December 1921.	Do.
Do. .	(591) Nagpur Manganese Mining Syndicate.	Do. . .	M. L. .	61·91	1st December 1921.	10 years.
Narsinghpur	(592) Mr. C. S. Harris .	Copper . .	P. L. .	212	18th April 1921.	1 year.

COORG.

Coorg	(593) Mr. Albert Henry Gaston, Madras.	Mica . . .	To prospect for and mine Mica.	412·90	31st August 1920.	Up midnight of 31st December 1921.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

MADRAS.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Anantapur .	(594) A. Ghosh .	Barytes . .	P. L. .	12·80	18th October 1920.	1 year.
Do. .	(595)B. P. Sesha Reddi	Do. . .	P. L. .	13·50	1st February 1921.	Do.
Do. .	(596) Moriston, Agent, Anantapur Gold Fields.	Gold . .	P. L. .	2,933·58	22nd February 1921.	Do.
Do. .	(597) B. P. Sesha Reddi	Asbestos . .	P. L. .	7·32	21st June 1921.	Do.
Do. .	(598) Do. . .	Barytes . .	P. L. .	42·77	Do. .	Do.
Do. .	(599) Do. . .	Steatite . .	P. L. .	27·96	30th July 1921.	Do.
Cuddapah .	(600) Messrs. Lakshmirattan & Co.	All minerals .	P. L. .	64·00	7th July 1921	Do.
Guntur .	(601) Messrs. Gillanders, Arbuthnot & Co., Calcutta.	Diamonds . .	P. L. .	42·70	8th January 1921.	Do.
Do. .	(602) The Travancore Mining and Trading Co.	Galena . .	P. L. .	640	16th April 1921.	Do.
Kistna .	(603) Messrs. Best & Co.	Coal . . .	P. L. .	242·94	24th June 1921.	Do.
Do. .	(604) The Hyderabad Deccan Co., Ltd.	Do. . . .	P. L. .	3577·60	27th July 1921.	Do.
Kurnool .	(605) B. P. Sesha Reddi	Barytes . .	P. L. .	4·20	2nd May 1921	Do.
Do. .	(606) Do. . .	Steatite . .	P. L. .	69·04	Do. .	Do.
Do. .	(607) Do. . .	Barytes . .	P. L. .	6·56	Do. .	Do.
Do. .	(608) Do. . .	Do. . .	P. L. .	3·03	Do. .	Do.
Do. .	(609) Do. . .	Do. . .	P. L. .	16·75	Do. .	Do.
Do. .	(610) A. Ghosh . .	Do. . .	M. L. .	55·45	3rd May 1921	30 years.
Do. .	(611) Do. . . .	Do. . .	M. L. .	66·07	Do. .	Do.
Do. .	(612) Do. . . .	Do. . .	M. L. .	49·60	12th June 1921.	Do.
Do. .	(613) B. P. Sesha Reddi	Do. . .	P. L. .	0·80	23rd August 1921.	1 year.
Do. .	(614) Do. . .	Do. . .	M. L. .	42·15	15th August 1921.	30 years.
Nellore .	(615) M. Varadia Reddi.	Mica . . .	P. L. .	27·90	14th March 1921.	1 year.
D .	(616) N. Raghavulu Nayakar.	Do. . .	M. L. .	57·00	17th January 1921.	30 years.
Do .	(617) S. Venkatasubba Reddi.	Do. . . .	P. L. .	16·64	28th February 1921.	1 year.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

MADRAS—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Nellore .	(618) K. Venkatasubbayya.	Mica . . .	M. L. .	1·63	7th January 1921.	30 years.
Do. .	(619) Mohcrji Cowasji .	Do. . . .	P. L. .	7 81	18th January 1921.	1 year.
Do. .	(620) S. Ramalinga Reddi.	Do. . . .	P. L. .	15·73	14th March 1921.	Do.
Do. .	(621) G. Gopalakrishnayya.	Do. . .	P. L. .	136·86	8th February 1921.	Do.
Do. .	(622) V. Rami Reddi .	Do. . . .	P. L. .	10·05	2nd February 1921.	Do.
Do. .	(623) V. Venkatakumara Krishna Yechendra, Bahadur.	Do. . . .	M. L. .	98·68	6th May 1921	a
Do. .	(624) Sankara Mining Syndicate.	Do. . . .	M. L. .	71·30 Extension of area held under previous lease.	4th October 1920.	Do.
Do. .	(625) R. K. Subbaraghava Ayyar.	Do. . . .	M. L. .	301·00	3rd April 1921.	Do.
Do. .	(626) R. Sundarami Reddi.	Do. . . .	P. L. .	3·07	26th May 1921.	1 year.
Do. .	(627) K. Ramasubba Reddi.	Do. . . .	P. L. .	26·20	1st March 1921.	Do.
Do. .	(628) T. C. Dandayutham Pillai.	Do. . . .	P. L. .	8·82	13th June 1921.	Do.
Do. .	(629) Do. . .	Do. . .	P. L. .	15·00	21st June 1921.	Do.
Do. .	(630) Messrs. Christien & Co.	Do. . . .	M. L. .	7·73	11th June 1921.	30 years.
Do. .	(631) T. Subbarami Reddi.	Do. . . .	M. L. .	30·09	23rd June 1921.	Do.
Do. .	(632) K. Panchelu Reddi.	Do. . . .	P. L. .	10·51	2nd April 1921.	1 year.
Do. .	(633) G. V. Subba Reddi	Do. . . .	P. L. .	150·30	15th May 1921.	Do.
Do. .	(634) I. Rama Subba Reddi.	Do. . . .	P. L. .	3·75	17th August 1921.	Do.
Do. .	(635) K. Panchelu Reddi	Do. . . .	P. L. .	4·14	Do.	Do.
The Nilgiri District.	(636) A. H. Gaston .	Do. . . .	P. L. .	56·57	14th June 1921.	Do.
Tinnevelly .	(637) Sri Krishna Doss of Bikaner.	Garnet . .	P. L. .	10·40	21st September 1921.	Up to the end of December 1921.

P. L.=*Prospecting License.* M. L.=*Mining Lease.*

NORTH-WEST FRONTIER PROVINCE.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Bannu .	(638) The Indo-Burma Petroleum Co., Ltd., Rangoon.	Kerosine oil .	P. L. .	18,880 acres in the Bannu and Dera Ismail Khan Districts.	5th February 1921.	..
Do. .	(639) The Rangoon Oil Co., Ltd., Rangoon.	Do. . .	P. L. .	19,200 between Pezu and Bain passes in the Bannu and D. I. Khan Districts.	5th November 1920.	1 year.
Hazara .	(640) R. S. Seth Chuhar Lal & Sons, Bankers, Abbottabad.	Minerals . .	P. L. .	29·7	17th September 1921.	Do.
Do. .	(641) Messrs. Lane Brown and Howlett, Civil Engineer, Lucknow.	Do. . .	P. L. .	9,999	15th December 1921.	Do.

PUNJAB.

Attock .	(642) Sir Vithaldas D. Thackersey, *Kt.*, of Bombay.	Mineral oil .	P. L. .	2,560	21st March 1921.	1 year.
Do. .	(643) Lt.-Col. Frank Johnson, of the firm of Frank Johnson & Co., Ltd., Calcutta.	Do. . .	P. L. .	800	10th February 1921.	Do.
Do. .	(644) The Attock Oil Co., Ltd.	Oil . . .	P. L. .	4,480	15th September 1921.	Do.
Do. .	(645) Whitehall Petroleum Corporation, Ltd.	Mineral oil .	P. L. .	24,480	22nd December 1921.	Do.
Do. .	(646) Attock Oil Co., Ltd.	Do. . .	M. L. .	1,278	23rd December 1921.	30 years.
Gujrat .	(647) Whitehall Petroleum Corporation, Ltd.	Do. . .	P. L. .	70,451·2	15th December 1921.	1 year.
Jhelum .	(648) Pandit Glan Chand of Dandot.	Coal . . .	P. L. .	5	26th August 1921.	Do.
Do. .	(649) Messrs. Madan Lal Manohar Lal.	All minerals other than oil.	P. L. .	564	17th September 1921.	Do.
Rawalpindi	(650) Rangoon Oil Co., Ltd.	Mineral oil .	P. L. .	2,880	9th November 1921.	Do.
Shahpur .	(651) The Indo-Burma Petroleum Co., Ltd., of Rangoon.	Petroleum . .	P. L. .	16,000	4th January 1921.	Do.

P. L.=*Prospecting Licenses.*

SUMMARY.

PROVINCE.	Exploring Licenses.	Prospecting Licenses.	Mining Leases.	Total of each Province.
Assam	...	8	...	8
Baluchistan	4	2	5	11
Bengal	...	1	...	1
Bihar and Orissa	...	20	17	37
Bombay	...	2	...	2
Burma	...	265	14	279
Central Provinces	...	217	37	254
Coorg	...	1	...	1
Madras	...	33	11	44
North-West Frontier Province	...	4	...	4
Punjab	...	9	1	10
United Provinces	...	...	...	...
Total of each kind and grand total for 1921	**4**	**563**	**84**	**651**
TOTAL FOR 1920	...	572	80	652

CLASSIFICATION OF LICENSES AND LEASES.

TABLE 41.—*Prospecting Licenses granted in Assam during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Cachar	4	20,582·4	Mineral oil.
Garo Hills	1	49,280	Coal.
Khasi and Jaintia Hills	1	7,504·8	Minerals other than mineral oil.
Sylhet	2	7,699·2	Mineral oil.
TOTAL	8	...	

TABLE 42.—*Exploring Licenses, Prospecting Licenses and Mining Leases granted in Baluchistan during 1921.*

DISTRICT.	1921		
	No.	Area in acres.	Mineral.
Exploring Licenses.			
Kalat	3	Bolan Pass, whole of Las Bela State and whole of Kalat State.	Mineral oil.
Sibi	1	Whole of Sibi District except Mari and Bugti countries.	Do
TOTAL	4	...	

TABLE 42.—*Exploring Licenses, Prospecting Licenses and Mining Leases granted in Baluchistan during 1921*—contd.

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Kalat	1	3,200	Mineral oil.
Sibi	1	49,606·4	Do.
TOTAL	2	...	
Mining Leases.			
Quetta-Pishin	1	10	Chromite.
Zhob	3	40	Do.
Do.	1	20	Asbestos.
TOTAL	5	...	

TABLE 43.—*Prospecting License granted in Bengal during 1921.*

DISTRICT	1921.		
	No.	Area in acres.	Mineral.
Chittagong	1	4,000	Mineral oil.

TABLE 44.—*Prospecting Licenses and Mining Leases granted in Bihar and Orissa during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Hazaribagh	4	582·8	Mica.
Sambalpur	4	7,808·99	Coal.
Do.	1	80·98	Mica.
Do.	1	86·91	Iron oxide.
Singhbhum	2	1,176·8	Chromite.
Do.	5	6,460·4	Iron-ore.
Do.	2	3,670·31	All minerals.
Do.	1	72	Manganese.
TOTAL	20	...	
Mining Leases.			
Gaya	1	486·6	Mica.
Hazaribagh	2	560	Do.
Sambalpur	2	745·76	Do.
Santal Parganas	11	20·27	Coal.
Singhbhum	1	2,624	Iron-ore and manganese.
TOTAL	17	...	

TABLE 45.—*Prospecting Licenses granted in Bombay during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Belgaum	1	499·65	Manganese.
Savantvadi State	1	620	Bauxite.
TOTAL	2	...	

TABLE 46.—*Prospecting Licenses and Mining Leases granted in Burma during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Akyab	2	6,720	Mineral oil.
Amherst	3	4,800	All minerals.
Do.	1	22,822·4	Oil shale.
Do.	17	21,149·88	All minerals except oil.
Henzada	2	1,468·8	Do.
Do.	1	2,560	All minerals including oil.
Do.	1	7,558·4	Coal.
Do.	2	2,804·1	Mineral oil.
Katha	10	44,609·6	All minerals except oil.
Kyaukpyu	1	2,105·6	Mineral oil.
Kyaukse	1	2,650	All minerals except oil.
Lower Chhindwin	10	53,529·6	Mineral oil
Do.	2	25,920	All minerals including mineral oil.
Magwe	1	300	Gold.
Do.	18	40,825·2	Mineral oil.
Mandalay	1	640	Iron-ore.
Do.	2	5,760	All minerals except oil.
Mergui	21	24,950·72	Do.
Do.	2	3,386·12	Coal.
Do.	7	4,361·78	Tin and allied minerals.
Do	7	7,051·52	Tin, wolfram and allied minerals.
Do.	6	8,432·88	Tin and wolfram.
Do.	5	5,204·48	Tin.
Do.	1	640	Cassiterite and gold.
Minbu	10	46,731·76	Mineral oil.
Do.	3	6,879·6	Coal.
Myingyan	7	16,997·42	Mineral oil.
Myitkyina	1	4,800	All minerals except oil.
Northern Shan States	2	6,400	Do.
Do.	1	3,200	Coal, copper and galena.
Pakokku	19	49,152·86	Mineral oil.
Prome	4	898·68	Do.
Shwebo	3	10,240	All minerals except oil.
Do.	6	25,185	Mineral oil.
Southern Shan States	4	3,280	All minerals except oil.
Do.	1	160	Antimony.
Do.	1	40	Lead.
Sagaing	1	1,675·08	Copper, silver and lead.
Do.	1	2·56	All minerals except oil.

TABLE 46.—*Prospecting Licenses and Mining Leases granted in Burma during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting Licenses—*contd.*			
Tavoy	42	28,527	All minerals except oil.
Do.	2	2,586	Coal.
Do.	1	4	Tin.
Thaton	6	6,828·8	All minerals except oil.
Thayetmyo	5	25,380	Mineral oil.
Do.	1	960	Coal.
Toungoo	1	148·48	All minerals.
Upper Chindwin	7	34,214·4	Mineral oil.
Do.	3	14,105·6	Coal.
Do.	1	1,824	Mineral oil and coal.
Do.	1	2,400	Gold.
Do.	1	1,560	All minerals except oil.
Do.	2	1,888	Gold and associated minerals.
Do	1	8,736	All minerals including mineral oil.
Yamethin	3	5,689·6	All minerals except oil
TOTAL	265	...	
Mining Leases.			
Magwe	1	1,920	Mineral oil.
Mergui	1	110·4	Tin and woltram.
Do.	2	1,677·37	All minerals except oil.
Minbu	1	471·72	Mineral oil.
Pakokku	2	806·4	Mineral oil.
Tavoy	7	6,649·75	All minerals except oil.
TOTAL	14	...	

TABLE 47.—*Prospecting Licenses and Mining Leases granted in the Central Provinces during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Minerals.
Prospecting Licenses.			
Balaghat	20	6,449	Bauxite.
Do.	51	6,316	Manganese.
Do.	1	533	Copper.
Betul	6	3,116	Coal.
Do.	1	635	Ferric oxide (ochre).
Do.	1	1,059	Manganese, iron and ferric oxide.
Bhandara	1	3	Manganese.
Bilaspur	1	1,630	Coal.
Chanda	1	614	Galena.
Do.	6	4,921	Coal.
Do.	1	709	Manganese.
Do.	2	744	Iron.
Chhindwara	14	2,101	Manganese.
Do.	83	20,646	Coal.
Jubbulpore	3	495	Bauxite.
Nagpur	23	2,783	Manganese.
Do.	1	185	Wolfram and galena.
Narsinghpur	1	212	Copper.
TOTAL	217	...	
Mining Leases.			
Balaghat	22	520	Manganese.
Betul	2	5,232	Coal.
Bhandara	3	86	Manganese.
Chanda	1	981	Galena.
Chhindwara	2	596	Coal.
Nagpur	7	219	Manganese.
TOTAL	37	...	

TABLE 48.—*Prospecting Licenses granted in Coorg during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting License.			
Coorg	1	412·90	Mica.

TABLE 49.—*Prospecting Licenses and Mining Leases granted in Madras during 1921.*

DISTRICT.	1921.		
	No.	Area in acres	Mineral.
Prospecting Licenses.			
Anantapur	3	68·57	Barytes.
Do.	1	2,933·58	Gold.
Do.	1	7·32	Asbestos.
Do.	1	27·96	Steatite.
Cuddapah	1	64	All minerals.
Guntur	1	42·70	Diamonds.
Do.	1	640	Galena.
Kistna	2	3,820·54	Coal.
Kurnool	5	31·34	Barytes.
Do.	1	69·04	Steatite
Nellore	14	436·78	Mica.
The Nilgiri District . .	1	56·57	Do.
Tinnevelly	1	10·40	Garnet.
TOTAL .	23	...	
Mining Leases.			
Kurnool	4	214·17	Barytes.
Nellore	7	567·52	Mica.
TOTAL .	11	...	

TABLE 50.—*Prospecting Licenses granted in North-West Frontier Province during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Bannu	2	38,080	Kerosine oil.
Hazara	2	10,028	Minerals.
TOTAL	4	...	

TABLE 51.—*Prospecting Licenses and Mining Leases granted in the Punjab during 1921.*

DISTRICT.	1921.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Attock	4	32,320	Mineral oil.
Gujrat	1	70,451	Do.
Jhelum	1	5	Coal.
Do.	1	564	All minerals other than oil.
Rawalpindi	1	2,880	Mineral oil.
Shahpur	1	16,000	Petroleum.
TOTAL	9	...	
Mining Lease.			
Attock	1	1,278	Mineral oil.

THE IRON-ORES OF SINGHBHUM AND ORISSA.

BY H. CECIL JONES, A.R.S.M., A.R.C.S., F.G.S., *Officiating Superintendent, Geological Survey of India.* (With Plate 6.)

Introduction.

The most important iron-ore area in India is situated some 150 to 200 miles to the west of Calcutta in the province of Bihar and Orissa and contains extremely large and rich deposits of iron-ore. These occur in the Kolhan Government Estate in the Singhbhum district, and in the Feudatory States of Keonjhar, Bonai, and Mayurbhanj. Good iron-ore is reported to occur also in the Feudatory State of Pal Lahara, and in the Zemindary of Sukinda, but these two latter areas I have not had the opportunity of examining. This note deals mainly with the Singhbhum district, and the Feudatory States of Keonjhar and Bonai. The deposits in these areas are remarkable for the enormous quantities of extremely rich ore they contain, and will undoubtedly prove to be amongst the largest and richest in the world.

In this note I propose to describe only briefly the geology of the area, and the investigation has not gone far enough at present, to enable me to put forward a theory of the origin of the ore; but everything points to the ore bodies being replacement deposits.

The Bengal Iron Co., Ltd., first started operations in this area in 1910, but during the last three years much prospecting work has been carried out by other Companies, and the Tata Iron and Steel Co., Ltd., the Indian Iron and Steel Co., Ltd., Messrs. Bird & Co., and Messrs. Villiers, Ltd., have all been granted or have applied for mining leases in the area.

History and previous literature.

Ball (*Mem. Geol. Surv. Ind.*, Vol. XVIII) gives a general account of the distribution of iron-ores in the districts of Manbhum and Singhbhum, but the localities mentioned by him are to the north of the areas examined by me.

Maclaren examined the auriferous occurrences of Chota Nagpur, and in his account (*Rec. Geol. Surv. Ind.*, Vol. XXXI) he describes the geology of the area, but does not mention the iron-ore.

Fermor in his account of the manganese-ore deposits of India (*Mem. Geol. Surv. Ind.*, Vol. XXXVII) refers to the iron-ores of Singhbhum, but deals mainly with the area near Chaibassa.

In the Quinquennial Review of the Mineral Production of India for 1909-1913 (*Rec. Geol. Surv. Ind.*, Vol. XLVI, p. 105) it is stated that 'Recently, magnetite and hematite have been obtained from the Manbhum and Singhbhum districts.' In this review it is also stated that 'the Bengal Iron and Steel Company, Limited,* have now given up the use of ores obtained from the neighbourhood of Barakar and Raniganj and are now obtaining their ores exclusively from the Kolhan Estate, Singhbhum.'

In the Quinquennial Review of the Mineral Production of India, for 1914-1918 (*Rec. Geol. Surv. Ind.*, Vol. LII, p. 112) it is stated that the main deposits worked by the Bengal Iron and Steel Co., Ltd., 'are known as Pansira Hill and Buda Boru Hill situated about 12 miles and 8 miles respectively south-east of Manharpur station, Bengal-Nagpur Railway. The total quantity of ore in sight in these two deposits is estimated at not less than 10 million tons. The ore is a high grade hematite with an average analysis of—

	Per cent.
Iron	64·0
Silica	2·10
Lime	·15
Alumina	1·25
Magnesia	·18
Manganese oxide	·05
Sulphur	·002
Phosphorus	·05

A 2′ 6″ railway line has been constructed by the Bengal Iron Company, Limited, from Manharpur to Pansira with

* Now known as the Bengal Iron Co., Ltd.

a branch through the Ankua Valley to Buda. An aerial ropeway with a capacity of 50 tons hourly transports the ore from the top of Pansira Hill to the light railway at the foot. The use of this ore makes the quality of the Company's pig iron equal to that of the best known imported brands.'

The iron-ores of Mayurbhanj State, from which the Tata Iron and Steel Co., Ltd., draw their supplies, were first noticed by P. N. Bose (*Rec. Geol. Surv. Ind.*, Vol. XXXI, p. 168), and have been examined and described more recently by Messrs. C. P. Perin and C. M. Weld (*Iron Age*, Vol. LXXXVIII; *Econ. Geol.*, Vol. X).

Maps available.

For mapping the iron-ore deposits, and in the estimation of quantities, the Forest Survey maps of Singhbhum on the scale of four inches to the mile proved extremely good. For the Keonjhar and Bonai States, however, the best maps available are the Bihar and Orissa sheets on the scale of one inch to two miles for a small portion of the northern parts of the States. For the remainder of the area in these States, the best maps are the old Bengal Survey sheets on a scale of one inch to the mile, made about fifty years ago. These maps are not contoured and are very inaccurate.

Owing to these unsatisfactory maps, to the hilly country covered with thick forest in which the iron-ore occurs, and to the uncertainty of the depth to which a replacement deposit extends below the surface, the estimates have necessarily been framed on very conservative lines.

Topography.

The area consists of a mass of hills and ridges largely covered with reserved and protected forests of sal trees. The small valleys between the hills are usually covered with soil, which has been cultivated. The hills rise about 1,000 to 1,500 feet above the valleys. The iron-ore, and the hematite-quartzites with which it is often associated, being the hardest and most weather-resisting rocks in the area, are mainly responsible for the topography of the country; and these rocks almost always form the tops of the hills. In Keonjhar State, the valleys are more open, but soil usually covers the rocks of

the low ground, so that with the exception of the hematite-quartzites, good exposures are seldom seen.

The general drainage of the area is towards the north-east,—the principal rivers being the Karo, the Koina, and the Baitarani.

Owing to its hilly character and the small extent of the plains, the area is sparsely inhabited, and the scarcity of roads makes travel and communication extremely difficult.

Geology.

The rocks of the area are shown by Maclaren in his account of 'The Auriferous Occurrences of Chota Nagpur, Bengal,' as Dharwars (*Rec. Geol. Surv. Ind.*, Vol. XXXI).

Fermor in 'The Manganese Ore Deposits of India' (*Mem. Geol. Surv. Ind.*, Vol. XXXVII, footnote p. 619), in referring to the area south of Chaibassa, says 'The but slightly metamorphosed character of these sandstones and grits and their gently rolling disposition would be more consistent with a Kadapah than a Dharwar age for them; but I think that in this case we have to deal with some Dharwar sediments that have escaped being much folded and have therefore been but slightly metamorphosed.' This is a point which early attracted my attention,—the metamorphism being very much less than one expects to find in Dharwar rocks, and I was not surprised at finding undoubted proof near Jagannathpur, south of Chaibassa, that the Iron Ore Series rests unconformably on the upturned Dharwar schists and quartzites.

Fermor in his Presidential Address to the Geological Section of the 6th Indian Science Congress[1] gives the following general classification of the Archæan rocks of Chota Nagpur:—

(1) Oldest gneisses and granites—not yet certainly identified.
(2) Dharwar sediments and contemporaneous lavas.
(3) Oldest gneisses re-melted—now post-Dharwar and probably forming a considerable portion of the 'fundamental gneiss.'

[1] *Proc. Asiatic Soc., Bengal*, Vol, XV, p. clxxvii.

(4) Post-Dharwar intrusives—

(*a*) Peridotites and other ultra-basic rocks.
(*b*) Granites and pegmatites.
(*c*) Epidiorites (altered dolerites and gabbros).

The Iron Ore Series, which has now been found to be of later age than the Dharwars (*cf.* p. 206), evidently lies between Fermor's groups 3 and 4; for though this series is certainly later than the Dharwars yet in places the lower beds of the series have been penetrated and absorbed by the granite.

The Dharwars are certainly the oldest rocks recognised in the area, and after their uplift and denudation, the rocks of the Iron Ore Series were laid down on them unconformably. A mass of granite was then intruded into the whole, but it seems to have raised and folded the Iron Ore Series rather than penetrated them to any large extent. This was followed by a period of basic intrusions, which took the form of dykes in the granite area, and to a less extent in the Iron Ore Series. There are also large quantities of interbanded basic igneous rock in the Iron Ore Series, some of which appears to be contemporaneous and some later than the Series. Some ash beds have been found in the interbanded igneous rock. These intrusions of igneous material were accompanied or followed shortly by folding and faulting of the Iron Ore Series on a very extensive scale. That there was more than one period of basic intrusion is proved by the presence of fragments of the basic rock in some of the fault breccias, with a similar basic rock acting as a cementing material to the same breccia.

Some intrusions of ultra-basic rocks also occur, but these have not been thoroughly examined.

The Dharwar rocks consist mainly of quartzites with hornblende-, quartz- and mica-schists. The strike and dip is variable.

The Iron Ore Series commences with a basal sandy conglomerate, ranging in thickness up to about 60 feet, and in places very coarse-grained; it consists of angular and rounded pebbles of red jasper and white quartz cemented together by purple sandy material. This conglomerate is overlain by

about 40 feet of purple and pale greyish limestone, which contains a considerable amount of fine-grained chloritic material along the bedding planes. This in its turn is overlain by a great thickness of shales, which are often very ferruginous and penetrated by thin veins of quartz. Above these shales come banded hematite-quartzites comprised of bands up to about an inch in thickness of hematite, chert and jasper in varying proportions. In places the hematite-quartzites are seen to pass along the strike into good ore. Above the hematite-quartzites is another thick group of shales, which is also often very ferruginous. Both groups of shales contain small lenticular beds of sandstone. The hematite occurs as a replacement product in the banded hematite-quartzite, and to a much less extent in the shales above and below the quartzite.

The rocks of the Iron Ore Series near the granite south of Chaibassa have a general north-north-east to south-south-west strike, and are gently folded. Towards the west the dips become greater, and the rocks have been very much folded and faulted. This faulting is well seen near Lipunga, and a strike fault apparently runs along the whole length of the east side of the main iron-ore range. The rocks to the west of the fault have a very steep dip in a westerly direction. In the north part of the range the banded hematite-quartzites and the hematite have a general north-north-east to south-south-west strike, and dip at about 70° to the west-north-west; but towards the south the strike becomes nearly north and south with a similar dip to the west.

Mineralogy and nature of the ores.

Practically the whole of the ore is hematite and as far as I know no quantity of magnetite occurs in the ore bodies. Small octahedral crystals occur in the ore occasionally, but they appear to be mainly martite (L. 584) as the rock has no appreciable effect on the magnetic needle. Small octahedral crystals some of which are magnetite and some of which appear to be martite occur also in the banded hematite-quartzite. The hematite is rather variable in character and the varieties may be grouped as follows:—

(1) Massive hematite.

(2) Laminated hematite.

(3) Micaceous hematite.
(4) Lateritic hematite.
(5) Hematite breccia.

(1) The massive ores, which are practically pure hematite, have a steel grey colour, and are usually extremely fine-grained and compact. This ore has a specific gravity of about 5·0 and specimens have yielded on assay 70 per cent. of iron, whilst samples of exposures of the massive ore yield over 66 per cent. of iron. These massive ores occupy about 8 cubic feet per ton, but usually pass into the laminated variety.

(2) The laminated variety is variable in character, varying from a solid reddish type (L. 567) through a solid laminated variety (L. 627) to a less solid laminated variety (L. 622) which is often inclined to a shaly character, and is often extremely porous (L. 624, L. 585). This shaly character is usually due to laminae of the massive grey variety interbanded with laminae of less compact ore, often of a reddish colour and usually very porous. The specific gravity varies considerably, depending on the proportion of the massive ore and the amount of porosity. Owing to their porous nature these ores often become hydrated, and tend to become laterit-ised. This type varies in density from about 10 to 12 cubic feet to the ton, ranging up to 15 cubic feet, when very porous. As would be expected from their nature, the iron content varies considerably, but is usually well over 60 per cent. and in some of the denser types it approaches very closely to that of the massive varieties.

(3) The micaceous variety is usually so fine-grained and unconsolidated that it falls into powder at a touch. This type is looked on with disfavour, as the material tends either to get blown out of, or to choke, the blast furnace. As it contains well over 60 per cent. of iron, it is much too valuable a product to waste, and could be used if it were either sintered or made into briquettes.

(4) The lateritic variety occurs in large quantity throughout the area, as a surface alteration product, sometimes of the iron-ore itself, at other times of the ferruginous shales, and at still other times of the hematite-breccia. The quan-

tity of iron in these types varies considerably and ranges up to about 60 per cent.

(5) The hematite-breccia (L. 628) consists of the debris material which accumulates on the slopes of hills, in old river valleys, and on plains between the hills, and it becomes cemented together by lateritic or hematitic material. A hematite-breccia (L. 576) caused by faulting has also been noted. In some cases, such as in Pachri Buru and in Thakurani Buru, there are big accumulations of this material, and as the fragments often consist of very solid hematite, these will give large supplies of good ore.

Quality of the ore.

On page 204, an average analysis of the ore at Pansira Buru is given. This agrees fairly well with a number of analyses given to me by the Tata Iron and Steel Co., Ltd., of samples collected from the deposits prospected by them:—

——	Sasangda.	Jarida area 18 samples.	Katamati 19 samples.	Pachri Buru.
Iron	64·3	63·74	63·33	63·94
Sulphur	0·015	0·019	0·030	0·024
Phosphorus . . .	0·058	0·080	0·088	0·072
Ins. Res.	1·12	2·35	2·14	2·49
Manganese	...	0·104	trace	trace
Titanium	...	trace	...	...

In the Sasangda deposit the phosphorus varies considerably, ranging up to a maximum of 0·103 per cent.

In the above samples from the Jarida Buru area the phosphorus varied considerably, namely, from 0·038 up to 0·152 per cent. Two of the above samples from the Katamati area were tested for titanium, and gave 0·25 and 0·20 per cent. titanium respectively. Four specimens from Pachri Buru tested for titanium, only gave traces.

The main points of these analyses are the high iron content, the low percentage of sulphur and titanium, and the variability of the phosphorus content. Manganese in any quantity seems to occur only in the lateritic variety of the ore.

The average of samples taken by me from the deposits at Sasangda, Jarida, Pansira, Gua, etc. and assayed in the Geological Survey Laboratory, gave about 64 per cent. of iron. Samples of the better parts of the deposits often run up to 68 or 69 per cent. of iron.

Methods of estimation of quantities of ore.

The estimates have been made almost solely from surface observations. In all cases the figures refer to ore-bodies containing not less than 60 per cent. of iron, and must be looked on as an absolute minimum. In the case of certain hematite debris (so-called 'float ore')[1] areas, it is probable that the debris covers solid ore, but prospecting pits are necessary to prove this. In these debris deposits, an average thickness of five feet has been taken and from 30 to 50 cubic feet of ground to the ton of ore. With the more massive ore the exactitude of the estimates depends largely on a correct appreciation of its porosity. For the solid ore, in no case has less than 10 cubic feet to the ton been taken, although theoretically 7 cubic feet of solid hematite goes to the ton, and there seems little doubt that ore from parts of some of the ore bodies, such as Pachri Buru, Joda, Sasangda, etc., will probably correspond in density very nearly to the theoretical figure. With the porous shaly ores 12 to 15 cubic feet has been taken to the ton.

With a replacement ore-body it is impossible to say what happens below the surface, but it is difficult to suppose that a big deposit such as the main iron-ore range, where the rocks dip at about 70° to the west, and where replacement has been almost continuous for a length of thirty miles, and across a series of beds varying from say 400 to 1,000 feet in thickness, will die out in a short distance from the sur-

[1] Fermor discards this humorous misnomer as applied to similar occurrences of manganese-ore and uses the term *detrital ore* or *talus-ore*. *Mem. Geol. Surv. Ind.* XXXVII. p. 563.

face. I have no doubt therefore, that replacement will be found in parts to have taken place to a depth of many hundreds of feet; but boring or other prospecting work is of course necessary to prove this. The slopes of the hills are usually covered, and it is only occasionally from observations of differences of height between the ore at the tops of hills, and the same bed of ore in streams cutting or running away from these hills, that one gets any idea as to the depth to which replacement has taken place. In no case however, has ore been taken as extending to more than 150 feet below the surface although from differences of height, a depth of ore of as much as 700 feet has been deduced.

Very little real prospecting work has been done by the various companies that have taken up or applied for areas, but from the small amount done, it seems possible that the solid ore may give place to the unconsolidated micaceous variety at depths of about 100 feet below the surface.

As will be seen the figures adopted for the estimates are all well on the conservative side, and I have little doubt that when the deposits have been opened up and proved by borings, etc., the true figures will be found to be more than double my estimates.

Distribution and quantity of ore.

The major part of the iron-ore seems to be fairly evenly divided between the Singhbhum District, the Keonjhar State and the Bonai State. The minimum quantities estimated up to the present for ore of not less than 60 per cent. of iron are—

	Tons.
Singhbhum district	1,074,000,000
Keonjhar State	806,000,000
Bonai State	656,000,000
Doubtful, Bonai State or Keonjhar State	280,000,000
Mayurbhanj State	16,000,000 (?)
TOTAL	2,832,000,000

I have not made an estimate of the quantities of ore in the Mayurbhanj State, and am unable to express any opinion on the correctness of the amount of 16,000,000 tons reported to occur there.

The iron-ore usually occurs at or near the tops of hills or ranges of hills, but near Jamda in the south of the Singhbhum District, and in parts of the Keonjhar State it is often found at very low levels, and in some cases actually in the plains themselves. The most important of these ranges of hills is the one that starts near Kompilai in the Bonai State, and continues to the north-north-east to a point about three miles south-west of Gua, a distance of about thirty miles. Running more or less parallel to this range, and possibly faulted from it, are other smaller ranges which contain good iron-ore. The main range rises some 1,500 feet above the plain, and iron-ore averaging over 60 per cent. of iron occurs for practically the whole length of the thirty miles. A few small breaks occur, where the rock has not been replaced, or where folding has occurred, but these are negligible compared with the total length. The rocks forming this range dip at about 70° in a north-west to west direction, so that the width of the outcrop of the iron-ore which varies up to 1,000 feet, gives practically the thickness of the ore bodies.

Transport of the ore.

Owing to the hilly nature of the country, it will prove rather difficult to get the ore away. The main line of the Bengal-Nagpur Railway, which runs in a more or less east and west direction, lies some twenty to forty miles north of the main deposits, and is separated from them by hilly country.

In the western part of the Kolhan, the Bengal Iron Co., Ltd., have a light railway running along the Koina river valley from Manharpur to their deposits at Pansira, with a branch running to their Ankua deposits. It seems doubtful if there is any other possible route into the western part of the iron-ore area on which extensive tunnelling would not be necessary.

In order to tap the deposits on the east side of the area, the Bengal-Nagpur Railway are constructing a line from Amda on the main line, through Chaibassa running down on the east of the hilly country, to the south of Singhbhum. This line lies to the east of the hilly country

and from it branches will be constructed to the various deposits in Singhbhum, and also to parts of Keonjhar State.

As far as I know, no definite scheme has yet been proposed for extracting ore from Bonai State.

The Bengal Iron Co., Ltd., transport their ore from the working places by means of gravity inclines and trams to central storage bins, from which it is taken by an aerial ropeway at Pansira, and by a self-acting incline at Ankua, to the foot of the hills.

EXPLANATION OF PLATE.

PLATE 6.—The Iron-ore Area of Singhbhum and Orissa. Scale 1" = 4 miles.

GEOLOGICAL RESULTS OF THE MOUNT EVEREST RECONNAISSANCE EXPEDITION.

BY A. M. HERON, D.SC., F.G.S., *Officiating Superintendent, Geological Survey of India.** (With Plates 7 to 13.)

I.—THE ARUN BASIN, TIBET.

Introduction.

The area geologically examined consists of over 8,000 square miles, included within a rectangle some 120 miles from east to west and 70 miles from north to south. This corresponds with the Tibetan portion of the drainage area of the Arun river, a complicated system of valleys the streams of which unite to form the Arun before it breaks through the main Himalayan range in the impressive gorge below Kharta. The headwaters of the Rongshar Chu and the Bhutia Kosi (Pö Chu) above Nyenam were also examined.

The southern watershed is the line of great snowy peaks running from the Khungphu or Nangba pass south-eastwards through Everest and Makalu to the Arun, and, to the east of the Arun, is the continuation of the range which divides Sikkim from Tibet, a range which lies considerably to the north of the great Kanghhenjanga group of peaks. The northern watershed may be the extension of what has been termed the Ladak or Northern range of the Central Himalaya; but here this is hardly a definite range, but rather a broad belt of high and much dissected country, with a few peaks of over 20,000 feet, distributed without linear arrangement. To the north of this watershed short tributaries drain to the Brahmaputra (Tsangpo).

I am greatly indebted to the promoters of the Expedition for the privilege of accompanying it and in particular to Colonel C. Howard Bury, D.S.O., the leader, for much assistance and practical interest in my work.

* Read before the Indian Science Congress, Madras. 1st. Feb.. 1922.

My work is virtually a continuation, to the westward, of Sir Henry Hayden's pioneer investigations during the Tibet Expedition of 1903-04[1]; with the exception of Sir Henry Hayden no geologist had visited this part of Tibet.

My mapping was done on a scale of 4 miles to the inch on skeleton maps furnished by the topographical surveyors as their plane-tabling proceeded. My very cordial thanks are due to Major H. T. Morshead, R.E., D.S.O., in charge of the Survey of India detachment, for many such facilities given and for valuable information, accompanied by specimens, from localities which I could not visit. Over a considerable portion of the area however my work had to proceed in advance of the surveys, geological boundaries in such cases having to be drawn on the maps subsequently from memory, supplemented by sketch maps and notes. The general conditions of the Expedition were indeed unfavourable to detailed work, in consequence of which I endeavoured to traverse as large an area of Tibet as possible and to lay down on the map with fair accuracy the boundaries of the different formations where they were accessible. A considerable amount of interpolation was however necessary and my work must be considered as a reconnaissance and nothing more.

If I had had the good fortune to accompany the second Expedition I had hoped to examine more carefully the crystalline area in the neighbourhood of Mount Everest, with the assistance of Major Wheeler's map, constructed from photographic surveys on a scale of 1 inch to 1 mile, and to cast some light on the many problems connected with the granites and gneisses and their relationships with the metamorphosed sedimentaries. The quarter-inch map was on too small a scale and was available too late to be of use in the mapping of the crystalline complex.

Geologically the area is divided into two:

(*a*) Tibetan and sedimentary to the north.

(*b*) Himalayan and crystalline to the south. This distinction is clearly displayed in the topography

[1] The Geology of the Provinces of Tsang and Ü in Central Tibet. *Mem. Geol. Surv. Ind.*, XXXVI, pp. 122-201, (1907).

resulting from the underlying geological structure, for to the north we have the somewhat tame, rounded and lumpy mountain ranges of Tibet, with their broad and flat-bottomed valleys, contrasting with the higher, steeper and more rugged Himalayas on the south.

Economically the Expedition met with nothing of interest. On moraines stones showing the green staining of copper compounds were now and again seen, but beyond that I saw no signs of mineralisation. A few clear fragments of pink tourmaline and garnet were picked up by the coolies, but none were sufficiently free from flaws to be worth cutting. I panned the gravels in several places for gold but without getting a colour.

Physical Features.

River systems.

The two main branches of the Arun river, the Phung Chu (or Men Chu as it is called in its upper portion) and the Yaru Chu (Ko Chu) flow from the west and the east respectively, in a general east and west direction, uniting near the village of Lashar and then flowing southwestwards and southwards through the main Himalayan range. The Yaru Chu rises in the hills to the north of Kampa Dzong and meanders through the broad plain which here lies at the northern foot of the snowy range, until at Sar it meets a high spur of crystalline rocks projecting northwards. This deflects it in a great sweep to the north-east and it finally cuts through the toe of this spur in the Rongme gorge, instead of flowing round its end. The Men Chu rises on the northern slopes of Gosainthan, above the Pekhü Tang, a great plain which contains a basin of enclosed drainage, the Pekhü Tso. On leaving the plain it finds its way for some distance along a valley excavated in a syncline of Cretaceous limestones and then cuts northwards in a fine gorge through intervening Jurassic shales to another parallel limestone syncline; some sixteen miles along this valley it is deflected back again to the original syncline by a N-S ridge-barrier of pegmatite

veins and hard shales. Along this syncline it then flows as the Phung Chu for between fifty and sixty miles to near its junction with the Yaru.

Two of its more important northern tributaries, the Shi Chu and the Lo Chu, also have their courses largely determined by the presence of the softer bands of Cretaceous limestones.

Parallel to the Phung Chu and joining the Arun twenty miles below the confluence at Lashar, is the Dzakar Chu. which, with its tributaries the Ding Chu and the Neo Chu, drains the mountainous district of Pharuk. In these tributaries also the synclinal origin of the valleys is distinct. The main drainage lines are therefore parallel to and dependent on the folding to which the region has been subjected; the general strike direction of the folds is W. N. W.—E. S. E.

Approximately at right angles to the longitudinal drainage system are a number of transverse tributaries. Those from the northern slopes of the Great Himalaya are turbulent glacial torrents with straighter courses and greater discharge than those from the Ladak range. Of the latter the more important occupy valleys intervening between tracts of high land which owe their prominence to their being composed of hardened and partly metamorphosed shales with clusters of intrusive granite veins.

Lakes.

Except for glacial tarns held up by moraine dams the Arun region is devoid of lakes; at either end however are basins of enclosed drainage, that of the Tso Mo Tre Tung to the east and to the west that containing the Pekhü Tso, the Kharru Ochen Tso and the Khömen Tso. All these are very shallow and vary greatly in extent according to the season of the year. In the broader valleys are extensive swamps and tracts temporarily flooded during the rains, and the so-called lakes are in fact little more.

Changes in drainage lines.

There is little doubt that the Arun has cut back through the Great Himalaya range and has captured a river which possibly flowed east from the vicinity of Gosainthan more or

less along the present courses of the Men Chu and the Phung Chu and then through the Jikkyop gap and over the plain to the south of Kampa Dzong: this river may even, as Hayden[1] suggests, have flowed northward to join the Tsangpo, perhaps on the line of the Nyang Chu, the river which passes Gyantse and Shigatse. The Dzakar Chu, now also captured by the Arun, probably joined the above conjectural river flowing northeastwards on a course approximately from the Küyok La above Lungme, along the present valley of the Arun between Kharkung and Lashar.

The Arun has two gorges. The lower, in which the river falls 4,000 feet in the 18 miles measured in a straight line between Kharta and Kyimatang, is fairly straight, with walls rising 5,000 feet and more in uninterrupted slopes so steep as to prevent human passage, but allowing bushes and trees precarious roothold. The upper gorge is an extraordinary one and so far I am unable to give an explanation of its origin. Where it enters the gorge the river is flowing through a fairly open valley with immense terraces of boulders and gravel, in the direction of the Küyok La, a low pass over comparatively soft schists. Abruptly the river turns upon itself and then plunges at a right angle into the heart of a high mountain (Yö Ri) of hard gneiss, in a gloomy canyon with almost vertical walls. Through this gorge the river flows south for three miles, then swings again and flows west for four miles, finally emerging from the gorge on the other side of the Küyok La, into an open valley which has exactly the same line and character as the original valley. Thus it cuts along two sides of a triangle in hard gneiss, in preference to following the hypotenuse in soft schists. The Rongme gorge on the Yaru Chu (Ko Chu of the map) is somewhat similar, as the stream now cuts through the end of a northward trending spur of gneiss and adjacent hard phyllites. It seems probable from the configuration of the country that the Yaru once flowed through the Jikkyop gap four miles to the north, the present course of the Chiblung Chu, and that it was subsequently captured by a tributary from the east.

[1] *Loc. cit.*, p. 129.

Glaciers.

I was able this year to devote only an occasional day or two to the vicinity of glaciers, but I am able to add my testimony to that of Hooker, Blanford, Hayden, Garwood and others, concerning the former much greater extension of glaciation. The present glaciers are but puny representatives of their former might, as shown by the huge moraines which encumber all the northern valleys. Two at least of the main glaciers of Makalu flowing to the Karma valley, show evidences of recent advance.

The Himalayan Zone.

The Himalayan and crystalline zone is essentially composed of a foliated and banded biotite-gneiss, usually garnetiferous, intimately injected with dykes and sills of all sizes of a schorl-muscovite-granite or pegmatite. The latter is often present to such an extent that it is the predominant rock. Forming an intermediate zone between the gneiss and the Tibetan sedimentaries is a band of metamorphic rocks, regarded as altered representatives of the latter; these are also penetrated by intrusions of the schorl-granite in great profusion. The metamorphic rocks appear to lie upon the gneiss, which is probably intrusive in them, but this point is one which I was unable to investigate. Other questions which arise are to what extent the gneiss represents very highly metamorphosed sedimentaries, and to what extent it is an injection-gneiss formed by the intrusion and rolling out of granite veins along the foliation of mica-schists.

Biotite-gneiss.

Although the rock shows but little variation in mineral constituents, it varies so greatly in their proportion, in structure, and in texture, that it is difficult to believe that the whole of the rock is of one origin. Much of it is undoubtedly derived from granite, as for example the porphyritic augen-gneiss type and a less common variety found in large amount near Kharta, in which thin and rather sparse foliae of biotite with abundant felspar form lenticles twisted and contorted in every direction. In the Kharta and Dzakar valleys this resembles a type common around Darjeeling, in which alternate

dark and light bands, biotitic and felspathic respectively form a rock which from a little distance has the appearance of a bedded sedimentary series. As is the case near Darjeeling, the planes of foliation or banding have usually low dips, and this variety is notably garnetiferous. Low down in some of the valleys towards the Nepal frontier, as for instance below Nyenam and Tasam and also probably near Kyimatang, large bodies of mica-schist are found, analogous to the schist occurring in the bottom of the Tista valley near Darjeeling and in other localities said to be found underlying the gneiss of Sikkim.[1]

The latter have been mapped by Bose as the Daling series; it is however uncertain whether the schist near the Nepal frontier belongs to an altered sedimentary series or is a variety of the gneiss.

Schorl-granite.

The schorl-granite varies in texture from a fine homogeneous granite to a coarse porphyritic pegmatite, sometimes with graphic intergrowths of quartz and felspar. It is the latest in age of the igneous rocks and occurs practically everywhere in the crystallines examined, penetrating both gneiss and metamorphics in veins and sills of all sizes. The habit of the sills is specially characteristic, namely concordance with the foliation of the rocks into which they are intruded.

Intrusion has taken place to such an extent that schorl-granite is often seen to be the predominating rock, and also its toughness and lack of joints and foliation cause it to resist weathering and abrasion in screes, moraines and streams, so that it nearly always is the main constituent of detrital accumulations. In addition to the essential minerals quartz, plagioclase, black tourmaline (schorl) and muscovite, the granite has as accessory minerals garnet, yellow and pink tourmaline, and beryl.

Metamorphic rocks.

The metamorphics comprise a considerable variety of rocks, all of which, except certain massive quartzites, are distinctly banded or foliated

[1] Garwood, in Freshfield's 'Round Kangchenjunga', p. 275; Mallet, *Mem. Geol. Surv. Ind.*, Vol. XI, p. 41 (1874); Bose, *Rec. Geol. Surv. Ind.*, Vol. XXIV, pp. 46, 221 (1891).

in layers of differing mineral composition, the directions of which are determined by the original stratification. They range from quartzites and micaceous quartzites to mica-schists and tourmaline-mica-schists, representing the arenaceous and argillaceous sedimentaries, with crystalline marbles and banded actinolite-, diopside-, and epidote-schists representing the calcareous rocks. Graphitic schists have also been noted, but are rare.

Considering how dislocated are the metamorphics due to intrusion of vein-granite, the comparatively low angles at which their planes of foliation lie as a rule, strike one in the field as surprising, especially in comparison with the intense crumpling which the same rocks have undergone in the Tibetan Zone. As one ascends any of the headwaters of the Dzakar Chu towards the Everest group, one leaves the twisted and crumpled Jurassic shales and passes downwards in the section, as the general dip is northwards, though actually rising in elevation, to the gently rolling limestones underlying them, which flatten out as they become more altered and the snowy range is neared. In the Rongbuk valley for instance, above the Chobu monastery, are limestones much fissured and veined with crystalline calcite, underlain by a thick sill of schorl-granite and pervaded by innumerable smaller sills and streaks. Some sixty feet of the limestone immediately above the main sill has been converted into amphibole-schist and below the sill is a band of mica-schists streaked and knotted with granite in *lit-par-lit* injection to such an extent that the product has a very strong resemblance to the banded variety of the biotite-gneiss. In the gorge of the Dzakar Chu between Kal and Tsa is exposed a great thickness of flaggy limestones with clayey partings. At the base of the section there are great masses of schorl-granite with amphibole- and epidote-schists; upwards the former becomes more definitely sill-like, interbedded with schists and finely crystalline and mottled limestone. The limestones remain crystalline for a considerable distance above the horizon of the topmost sill and then pass upwards into black limestones, non-crystalline and calcite-veined, and are finally succeeded by Jurassic shales and

quartzites. In the valleys above Raphu and Chödzong alteration takes place independently of granite intrusions, calcite-veined, knotted and brecciated limestones passing downwards into pyroxene-, actinolite- and epidote-schists. In the above-described sections the change from sedimentary to metamorphic rock is very clearly seen, taking place gradually in magnificent cliff-faces with no break nor discordance in the stratification; from a short distance away it is indeed often impossible to say whether one is looking at limestone or calc-schist.

Speaking generally it may be said that the valleys to the north-west and north of Everest, *i.e.*, valleys above about 15,000 feet, are excavated in metamorphic rocks, whereas those to the north-east and east, for the most part below about 15,000 feet, are in gneiss. It was impossible, in the time at my disposal and with a small scale skeleton map, to attempt to lay down a boundary between metamorphics and gneiss, but it would appear possible that the metamorphics form a sheet dipping gently northwards and underlain by the gneiss. The gneiss is probably intrusive in the metamorphics, judging from evidences of its age elsewhere in the Himalayas, and it may be possible to ascertain this definitely on further investigation.

The group of high peaks between the Nangba La and the Rongbuk glacier, and the north-western side of Everest itself up to the summit are composed of metamorphics, with, of course, much schorl-granite, to the resistant power of which, and not to the easily eroded metamorphics, is due to the eminence of these peaks. When I visited the Kharta and Karma valleys on the east of Everest before the end of the monsoon, the mountain was too much covered with fresh snow to show any geological structure. The base of Makalu in the Karma valley is gneiss, but Col. Howard Bury states that its upper portion is pale granite.

Amphibolites.

In the neighbourhood of Dak in the Arun valley, numerous fragments of amphibolites, both foliated and granitoid, were observed, but the parent mass was not found. The nature of these amphibo-

lites is therefore uncertain, but they are probably altered igneous rocks of intermediate or basic composition.

Tibetan Zone.

The Tibetan Zone consists in the main of a great thickness of intensely folded Jurassic shales, the folds in general striking east and west. Pinched up in these folds in several very elongated and narrow synclines, are limestones belonging to the Kampa System of Hayden, of Cretaceous and Eocene age. These synclines are closely compressed and overfolded, their axial planes dipping to the north, showing that the compressive force which produced them acted from that direction.

Along the southern border of the Tibetan Zone, below the base of the Jurassic shales, is a great thickness of flaggy limestones, in which the fossils have been destroyed and the rocks themselves converted in part into crystalline limestones and calc-schists. The age of these cannot be determined with certainty, but their character and position in the sequence indicate that they are possibly Trias or Permian.

From a palæontologist's standpoint the country which I covered was very disappointing, but I am, nevertheless, much indebted to my colleague, Mr. G. H. Tipper, for identifying for me the small collection of fossils which I made. The Jurassic shales are almost unfossiliferous and yielded only a few ammonites, belemnites, and crinoid stems of little interest. The thick limestones bordering the crystalline zone show, near their top, abundant signs of organisms in the form of curved layers of crystalline calcite which in all probability are the remains of large lamellibranchs or brachiopods; but in several days search in favourable localities I failed to discover a single specimen showing anything more definite.

The Eocene and Cretaceous limestones, the zones of which have been worked out in great detail by Sir Henry Hayden in the magnificent and less disturbed sections of the Kampa ridge, here occur in much compressed synclines, in which fossils have been destroyed or damaged by the shearing

which they have undergone and in which it is almost impossible to work out the zones owing to faulting and interruption by stretches of alluvium. It is only in the Tsipri ridge that a satisfactory and detailed study of the Eocene and Cretaceous rocks can be made; but for this I was unable to spare the time, for when I passed it I had been separated from the Expedition by floods and had exhausted all my money and almost all my food. It is, however, unlikely that I could have added anything of value to Sir Henry Hayden's description of these rocks.

The Kampa System.

The Kampa System is developed in two main synclines, the northern of which may be called the Tsipri syncline from the picturesque and sacred ridge on it, and the southern the Phung Chu syncline, from the chief river of this area, which has excavated its valley along it; there are besides a number of smaller synclines.

It is in the northern syncline only that the Eocene beds above the 'ferruginous sandstone' of Hayden* are found.

In the exposures between the Yao La and Gutso this 'ferruginous sandstone' is a massive pink and white quartzite, about 100—150 feet thick, weathering into large blocks. In its degree of metamorphism it is like a typical Pre-Cambrian quartzite, although the brown shales below it and the blackish grits above are almost unaltered; the latter contain dicotyledonous fossil wood, and are the highest formation present in the section.

The Tsipri ridge gives the only fair sections of the combined Eocene and Cretaceous of the Kampa System. I was unable to examine this in detail but the general section is as below:—

Bold scarp . . .	Massive thick-bedded grey limestones with abundant *Alveolina* and *Operculina*, alternating with massive, white, very fine-grained and unfossiliferous limestones and thin-bedded limestones.

* *Loc. cit.*, pp. 165, 169-172.

Minor scarp . . .	A series of limestones in regular beds of medium thickness; about the middle of this series comes the 'ferruginous sandstone.'
Undercliff of above .	Grey flaggy limestones.
Lower scarp rising from plain.	Brown argillaceous limestones in thin regular beds.
Usually covered, but exposed at east end of ridge.	Great thickness of grey unfossiliferous calcareous shales.
East end of ridge . .	Black and brown splintery shales with large septarian nodules.
North side of Shi Chu valley.	Grey limestone. Massive quartzite, the 'wall' quartzite.

The upper limestones on the south side of the ridge are corrugated and as they pass to the northern side dip steeply up to vertical; further north, on the northern side of the Shi Chu valley, the limestones and quartzite at the base of the syncline are inverted, with the Jurassic shales overlying them and dipping to north at 30° to 80°. The Shekar hill shows a subordinate anticline formed to the north of the main syncline. At the western end the outcrop of the topmost limestones descends to plain-level due to a westward pitch of the syncline; in the short ridge to the west of Temi, they show undulating dips and a great overfold.

In the Tsipri ridge the ferruginous sandstone is not so highly indurated as in the Yao La sections; it contains abundant spherical concretions of iron oxide and is in certain layers finely conglomeratic, the little pebbles, of the size of buckshot, consisting of transparent quartz, quartzite of various colours, and white chert.

At the western end of the northern syncline, where it emerges from the alluvium of the Pekhu plain, the Cretaceous limestones, in their upper portion, contain numerous intercalated thin bands of sandstone and are themselves distinctly arenaceous, indicating, with the occurrence of fossil wood in the Eocene grits above the ferruginous sandstone, the prevalence of shallower water conditions than obtain as one passes to the east.

The structure is that of a recumbent isocline, of which both limbs dip north at 20° to 40°, affected however by minor rollings and corrugations; the northern margin is considerably altered by metamorphic agencies connected with the granite intrusions of the Northern Range.

Locally, the prominent sandstone-quartzite band which is found elsewhere in the shales a little distance below the base of the limestones is wanting. This I call the 'wall' quartzite. Here there is a passage into the Jurassic shales through shaly limestones. Just below these passage beds, at Menkhap Me and on the Lungchen La, fragments of ammonites of Upper Jurassic type, but not determinable with certainty, were found.

East of Gutso and Menkhap Me a broad alluvium-filled river-valley and a southward-trending spur of semi-metamorphic rocks and granite veins (the Burtra ridge) cut off this syncline, but there is little doubt that it is structurally continuous with that of Tsipri.

The Tsipri syncline has been described above. It also is overfolded by pressure from the north. To the east of Shekar the outcrop of the syncline narrows, through the beds becoming more vertical, and as it swings to the north-east in the valley of the Lo Chu it flattens out again to a very recumbent isocline.

A day's search in the Cretaceous beds round Shekar failed to yield a fossil. The beds appear to have been sheared to some extent and are shattered and veined with calcite, but have not been rendered crystalline; in the Lo Chu valley the shaly partings between the limestones are silvery from the presence of sericite mica.

The Phung Chu syncline, also, is overfolded, but not to quite the same extent as the Tsipri syncline. It also extends to an unknown distance through the Pekhu plain to the westwards. Where first encountered, in the west, the Men Chu flows along a valley excavated therein; to the south lies a wide plateau of undulating Jurassic shales, on which is a shallow saucer-like syncline containing the 'wall' quartzite and a trifling thickness of limestone above it. At the edge of this plateau the shales and the 'wall' quartzite roll steeply over into the Men Chu valley.

On the northern bank of the stream is a fine scarp of regularly bedded limestone, in places crowded with small lamellibranchs (unidentifiable) and what appear to be casts of brachiopods in crystalline calcite. To the north of this a double fault is well seen, bringing the limestone against the 'wall' quartzite and the Jurassic shales, which dip vertically at the junction.

Between Nelung and Tingri, where the Men Chu, now known as the Phung Chu, returns to and again excavates a valley along the syncline, both limbs dip northward at about 60°. From Tingri eastwards to where the syncline disappears near Tsonga, the southern limb is fairly regular and the 'wall' quartzite stands up conspicuously along the valley, dipping at angles of 45° to 80°. Its boldness and continuity along this valley led me to give to this distinctive bed the field name which I have used here. It is about 120 feet thick; next above it is a thin but massive limestone followed by 300-400 feet of shales passing into the slabby limestones, which form the bulk of the visible section.

The northern edge is not so regular; usually it is overfolded, but in places the dip is high but normal; south of Shekar runs a strike fault cutting out the 'wall' quartzite. South of the Tsipri ridge the two synclines approach closely, with an intervening anticline of Jurassic shales. All along the Phung Chu valley exposures of the Cretaceous limestones are much disconnected by detrital deposits, and usually occur as isolated hills of bizarre form, in which the beds are seen to be intensely crumpled and sheared, and fossils are represented by streaks of calcite. At Kyishong, near its eastern end, the syncline widens out, due to the presence of a subsidiary anticline along its centre.

The groups of synclines to the south, in the Pharuk district, display such great irregularities and complexity of structure that I found it impossible to map them in detail on a $\frac{1}{4}$ inch scale and have been compelled to show them in a general and diagrammatic way. The syncline that forms the valley of the Neo Chu and passes eastwards to near Aya, is very elongated and narrow, with the strata disposed vertically or slightly overfolded in the usual direction, and the 'wall' quartzite standing up on either side of the valley. Midway

along the syncline a strike fault repeats it, bringing in a wedge of Jurassic shales. At its western end, it is continued by another similar syncline, slightly *en échelon*. In the two miles south of the Neo Chu syncline, between Namda and Tashidzom, the "wall" quartzite and the basal beds of the Cretaceous limestones are repeated again and again by sharp folds and faults of small throw. Needless to say they are veined with calcite and in places brecciated. South of this again, from Tashidzom to Kuyul, besides the double syncline shown on the map, small sections of the Cretaceous limestones are pinched up and faulted into the Jurassic shales.

In the double syncline there is no inversion, the northern lobe being shallow, saucer-like, and fairly symmetrical, while in the southern the beds are undulating and almost horizontal.

The only remaining outcrop of Cretaceous rocks lies far to the north-east, and is a shallow syncline similar to the last, with the quartzite dipping gently inwards round the periphery and the centre occupied by horizontal and undulating sericitic limestones.

Jurassic shales.

The most striking features, in fact the only striking features of the Jurassic beds, are the extent and the monotony of their outcrops. They consist for the most part of dark brown and black shales and argillaceous sandstones, with subordinate quartzites, representing a purer type of sandstone, and limestones which are usually darker and more argillaceous than those of the overlying Cretaceous System.

In the tract of country between the crystalline zone and the Northern Range of the Central Himalaya, the Jurassic strata are thrown into great folds and corrugated in the most fantastic fashion, and even in cases where the general dip approaches horizontality the beds roll about irregularly. In such highly compressed country, faulting, especially thrust-faulting, must be very prevalent, but where strata are so uniform in appearance such faulting is extremely difficult to detect.

The general strike of these folds is that of the 'grain' of the country, *i.e.*, in a E.-W. or E.S.E.-W.N.W. direction, but the folds are subject to far more irregularities than is

the case in the more persistent synclines of the Kampa System limestone.

In the Northern Range, and also where they pass downwards into the thick limestones along the boundary of the crystallines, the shales dip less variably and at lower angles. A certain amount of injection by granite veins has taken place in the Northern Range accompanied by a widespread regional induration of the rocks, which attain, however, to only a low degree of metamorphism. The intermediate belt, where the Cretaceous and Eocene limestones have been compressed into overfolded synclines and the Jurassic shales have been so intensely folded, has been a region of weakness between two more resistant blocks. The alteration of the rocks in the Northern Range extends considerably further outwards from the areas of granite intrusion than is the case in the opposite section of the Great Himalaya, but is, as I have said, of less degree. Pebbles of garnetiferous mica-schist and hornblende-schist (of the 'feather amphibolite' type) were found in gravels below the Mon La, but the parent rock was not found *in situ* nor were such highly metamorphosed types met with elsewhere in the Northern Range.

For the most part the shales have become hardened and have acquired the beginning of slaty structure, being knotted and breaking into prisms, or have had developed in them a certain amount of secondary sericitic mica and of aluminous silicates such as staurolite; in certain cases they have become phyllites. Often they have a baked appearance, being whitish or red, contrasting with the black or rusty brown tints of the unaltered shales. The quartzites show no more alteration than they do amongst the unaltered strata, but then in this area the usual Jurassic sandstone-quartzite, fairly free from impurities, is just as hard and vitreous as any typical Pre-Cambrian quartzite.

Igneous rocks in the Tibetan Zone.

The intrusive granite of the Northern Range is very similar in appearance to the schorl-granite of the Himalayas, but is uniformly fine-grained instead of showing the great variation in texture of the latter rock. Like it, it is a white rock and is very tough and resistant to weathering.

Mineralogically it differs from the schorl-granite in that it contains biotite (with muscovite as well) instead of schorl, and from the Kyi Chu granite described by Hayden, it differs in the absence of hornblende and the scarcity of plagioclase and of sphene, epidote and calcite.

Near Nelung and Khakyu, and between Namda and Aya, small dykes of dark rock were seen, in the last case strung out along a line running E. and W. appearing at intervals over a length of 2½ miles. The dykes individually extend for only a hundred feet, less or more, and are up to 3 feet in width. The rock is too thoroughly decomposed for determination, but is probably of basic composition. Judging from the crushing and dislocation which the dykes have undergone they are probably antecedent in age to the folding of the rocks. Pebbles of an augite-bearing rock, probably of basaltic or andesitic composition, but with felspars too much altered to be determinable, are common in the gravels of the Phung Chu and may be derived from such dykes.

Permo-Trias limestones.

Between the crystalline and the sedimentary zones crops out a thick series of limestones, of which 2000 to 3000 feet are exposed in a very uniform assemblage of rather thin beds of 1 to 3 feet in thickness, with shaly partings. The overlying shales, of which the major portion has been shown by Hayden to be Jurassic, pass down without any visible discordance into the limestones. As has been stated, the limestones as a whole are considerably altered, all fossils having been destroyed and now appearing as streaks of crystalline calcite. Further, they have been extensively invaded by granite veins, converted into crystalline limestones and calc-schists, and involved in the crystalline complex in such fashion that to lay down a true boundary upon the map is impossible. The line which I have drawn between limestones and crystallines is an arbitrary one and represents generally the upper and outer limit of granite intrusions; to the south of this line there is much of the limestone in its metamorphosed forms, but intimately associated with the schorl-granite. The lowest portions of the limestones are thus obliterated and their relation to the biotite-gneiss is obscure, but it is probable that the latter is intrusive in

them. The limestones were probably continuous right along the southern margin of the Jurassic exposures, but the zone of metamorphism and granite veining has encroached on them to a varying extent, in some places affecting them throughout and transgressing upwards as far as the Jurassic shales and in others leaving a great thickness unaltered, so that their outcrop has now the irregular breadth shown upon the map. Their general dip is northward at low angles; at Yalep on the Po Chu and at Kal are anticlinal flexures and south of Raphu and Hlelung dips undulate somewhat.

The bifurcation of the outcrop east of Tulung is, as far as I was able to ascertain, due to the limestones emerging again to the north of the main exposure along an anticlinal axis; the structure is however doubtful and may be due to faulting. My examination of this portion of the area was much hindered by repeated snowfalls and heavy mist.

The age of these rocks is very doubtful, but may be put down provisionally as Permo-Trias. Sir Henry Hayden[1] has described, under the name of the Dothak series, an assemblage of limestones and other sedimentary rocks between the Chumbi valley and Bhutan, which in his opinion may include part or all of the Trias and possibly one or more of the Palaeozoic systems.

He also suggests that Triassic rocks occur along the northern slopes of the Lhonak range between Tibet and Sikkim,[2] and fossils typical of the Productus Shales (Upper Permian) are known to have been collected from near the Kongra La, the pass which crosses the Lhonak range south of Kampa Dzong. The situation of these exposures with regard to the crystalline zone is very similar to the belt of Permo-Trias rocks described above.

Direct evidence of their age, though not very definite, is given by two sections in the ridges to east and west of Hlelung. At the base of the great series of shales which overlie the limestones, just as they pass downwards into the latter, is a thin ferruginous bed crowded with *Spirifer* and *Productus*, not, however, specifically determinable. These

[1] *Loc. cit.*, p. 142.
[2] *Loc. cit.*, pp. 144 and 145.

would indicate that the top of the limestones is about Upper Permian in age, if the section is a straightforward one, which there is no reason to doubt. The bulk of the limestones would then represent the Permian of the European scale, with perhaps a portion of the Carboniferous. Judging from field relationships and lithological characters, I had in my own mind considered these limestones as approximately equivalent to the Kioto limestone of the Zangskar range in Spiti (Lower Jurassic and Upper Trias) which in that country underlies the Spiti Shales (Upper Jurassic), but the fossil evidence puts them much lower in the geological scale, and indicates that the Trias is represented by the lower portion of the great succession of shales; it is unfortunate that the absence of recognisable fossils from the limestones themselves leaves the question so indefinite.

IIE GEOLOGICAL STRUCTURE OF MOUNT EVEREST.

During the attacks on the mountain by the climbers of the second Expedition, a small collection of rock-specimens was made at heights of from 23,000 to 27,000 feet. I am greatly indebted to those who collected them, at altitudes and under difficulties hitherto unequalled in geological field-work.

These specimens confirm the views arrived at last year, as a result of inspecting the mountain by telescope from the Rongbuk valley from a distance of about ten miles, and by examination of moraine material derived from its northern faces and spurs.

These data show Mount Everest to be a pile of altered sedimentary rock—shales and limestones—converted into banded hornfels, finely foliated calc-silicate schists and crystalline limestones. The hornfels and fine schists are in the field blackish or dark green rocks, conspicuously slabby and with a general low dip to the north, which. I believe adversely and even dangerously affected climbing. The crystalline limestones are fine-grained pure white rocks.

A general description of the various types has been given in the paragraph on metamorphic rocks and it may suffice

to say here that the actual specimens from 23,000 and 25,000 feet show in microscope sections a very fine-grained aggregate of quartz and a greenish mica, with irregular lenticles and veins of chlorite and epidote and in addition sometimes calcite and sphene.

The mountain, from 21,000 to 27,000 feet, is made up of these black and dark green rocks, with occasional beds of white limestone and veins of quartz and muscovite-granite. From 27,000 to 27,600 feet extends an almost horizontal belt, a sill in fact, of schorl-muscovite-granite, along the whole length of the mountain, which rock presumably, by its superior hardness, gives rise to the prominent shoulder of the mountain north-east of the main peak (shown as 27,390 on Major Wheeler's photographic survey map). Above this again are black schists.

As to the age of the rocks forming Mount Everest, they may perhaps be assumed, for the present, to be Jurassic or Trias.

EXPLANATION OF PLATES.

Plate 7.—View of Mount Everest from the north.
Plate 8.—Geological map of the Arun River Area, Tibet: scale 1″=8 miles.
Plate 9.—Diagrammatic Sections across the Arun river area, Tibet.
Plate 10.—Fig. 1.—Alluvial gravel terraces and hills of Jurassic shales, Kyishong, Phung Chu valley.
Fig. 2.—Folded Cretaceous limestones, Men Chu above Mento.
Plate 11.—Fig. 1.—Folded Jurassic shales.
Fig. 2.—General view of Phung Chu valley, from Memo, looking east, Tsipri ridge on right.
Plate 12.—Fig. 1.—Synclinal hill of Cretaceous limestone, Memo, Phung Chu valley.
Fig. 2.—Eastern end of Tsipri ridge, showing folded Cretaceous limestones.
Plate 13.—Fig. 1.—Folded Cretaceous limestones, Palding near Dzakar Chu.
Fig. 2.—Folded Cretaceous limestones, Riphe near Dzakar Chu.

THE NORTHERN EXTENSION OF THE WOLFRAM-BEARING ZONE IN BURMA.

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In a paper entitled 'The Distribution of Ores of Tungsten and Tin in Burma,' published in the *Records of the Geological Survey of India*, Vol. L, pp. 101-121, (1919), we summarised briefly the information then available regarding the located deposits of these ores, tracing them district by district from Byingyi on the borders of Yamethin and Loi Long in the Southern Shan States, to the southern extremity of the Mergui district. We demonstrated there that all the wolfram and cassiterite veins in Burma are closely associated with a biotite boss-granite which forms the cores of the ranges of the Indo-Malayan mountain system. At the time that paper was written the Byingyi occurrence marked the northern termination of the zone.

Since then however other occurrences have been located and although little is known of them and they have not proved of any economic importance, we consider it desirable to place on record the information we possess regarding them.

Southern Shan States, Yengan State.

Yengan is one of the most northerly of the States in the Myelat division of the Southern Shan States, lying between 20° 55′ and 21° 14′ N. and 96° 13′ and 96° 38′ E., with an area of 400 square miles. It is separated from the Meiktila district in Burma by a lofty mountain barrier rising in places to over 5,000 feet in height. The whole of the western part of the State is hilly and drained by the Panlaung river and its affluents. Five prospecting licenses for wolfram covering a total area of 8,000 acres, had been granted in the State by the end of 1918, but details are available concerning only one of them, held at that time

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The concession lies on the banks of the Panlaung river, 15 to 18 miles due east of Thedaw railway station, at mile 322 from Rangoon in the direction of Mandalay. In it there are two main granite exposures separated by a series of altered sedimentary rocks, chiefly clay slates and hard white quartzites. Compact grey limestones are also found but their relationship with the other series is not known. Numerous quartz veins varying in thickness from a few inches to three feet, traverse both the granite and the clay slates and quartzites. Their strike varies from a few degrees north of east and south of west to N. E.—S. W., and the dip is generally steep towards the north. The thinner veins often die out in a short distance along their strike and are replaced by parallel ones *en échelon*. Close to the granite contact they contain wolfram both in the granite and sedimentary rocks, but further away they become barren. The veins are said to be most productive when they occur in fissures at right angles to the major axis of the intrusion. As is usual in better known localities, the distribution of the wolfram within the veins is irregular and patchy and greisenisation is common where they traverse the granite. In one part of the concession molybdenite occurs with the wolfram. Oxidised compounds of copper and iron are found in the upper portions of the veins and appear to indicate the presence of sulphides below the zone of decomposition.

Mawnang State.

Mawnang, a small State of the Myelat division of the Southern Shan States, known to the Burmese as Bawnin, lies between 20° 38′ and 20° 44′ N. and 96° 44′ and 96° 51′ E., with an area of 40 square miles. In November 1918, the Superintendent of the Southern Shan States reported that wolfram had been found on a small concession in Mawnang. The total output from the concessions in

Mawnang and Yengan States in 1917 and 1918 approximated only $2\frac{1}{2}$ tons.

Kyaukse District.

Returns of mineral production for 1919 record the output of 2 cwts. of wolfram from the Kyaukse district. This was obtained in the course of prospecting operations on concessions near Sabedaung and in the Pyetkaywetaung forest reserve of the Myittha township between the villages of Kyidankanzwe and Zalonegaw. No information is obtainable regarding this prospect, which appears to be the most northerly reported occurrence of wolfram in Burma. Myittha itself is only some 35 miles in a direct line southwards of Mandalay.

Conclusion.

The striking similarity between the geological conditions, vein structures and mineral associations of the Yengan concession and those described in our earlier paper are apparent. The almost constant recurrence of such features amongst practically all the various wolfram deposits which have hitherto been described, stretching as they do over hundreds of miles of territory further to the south, appear to us to indicate a strong probability of the presence of identical rocks with similar origins in those occurrences of which we know nothing, beyond the mere fact of their existence, at present.

MISCELLANEOUS NOTE.

Barytes in Alwar.*

During a mineral survey of Alwar in the year 1911 by the writer, deposits of barytes, one at Bhankhera (27° 32′ : 76° 38′) three miles south-west of Alwar City and another at Ramsinghpur (27° 10′ : 76° 32′) ten miles south-west of Rajgarh Railway Station (Bombay, Baroda and Central India Ry.), were discovered. A third deposit was subsequently discovered at Jamraoli (27° 9′ : 76° 44′) ten miles south-east of Rajgarh railway station, but the quality of the material is inferior and the commercial value of the deposit is doubtful.

Some attention has been devoted to the development of these deposits and some 12 tons were despatched to Calcutta about the year 1919 for testing purposes as paint.

Recently another outcrop of barytes was noticed by the writer at Sainpuri (27° 46′ : 76° 43′) 4 miles north-north-east of Parisal Railway Station. The vein was traced for 110 feet and is approximately 15 feet thick. It is coarsely crystalline, pure white in colour and in quality appears to bear comparison with the Madras barytes. It is considered that the exploitation of this particular deposit should be remunerative.

The four deposits of barytes all occur in the Alwar quartzites, a series in the Delhi system corresponding perhaps to a low horizon of the Purana group (Pre-Cambrian). Further search along the outcrops of these quartzites may possibly reveal the presence of other deposits of the same mineral.

The barytes is not an original constituent of the quartzite ; it invariably occurs in veins filling fissures opened long after the formation of the quartzite. All the deposits so far discovered are situated near the base of the hill slopes and are absent from the crests of the ridges, a fact which seems to indicate that the barytes-bearing veins characterise the less compact and more easily weathered varieties of the quartzite. Except at Jamraoli, the strike of the fissure-veins generally agrees with that of the bedding.

The junction between the barytes and the 'country' is quite abrupt just as it is in the case of the quartz and pegmatite veins of this region. There is no impregnation of the 'country' along the walls by the vein minerals which, contrary to what has been observed in the case of the ancient intrusive amphibolites of this region, do not penetrate into minute joints nor into planes of bedding.

* Published with the kind permission of His Highness the Sri Sewai Maharaj Dev of Alwar.

The intrusive rocks of the Alwar region have been classified by Dr. Heron according to their relative ages into three groups (*Mem. Geol. Sur. Ind.*, Vol. XLV, p. 88).

3. Pegmatites.
2. Granites.
1. Amphibolites.

The barytes veins have probably crystallised from solutions at a relatively low temperature, and at no great depth. They belong to a later geological phase than that of the intrusive granites and pegmatites to which they are probably totally unrelated in origin.

SRI KUMAR ROY,
State Geologist, Alwar.

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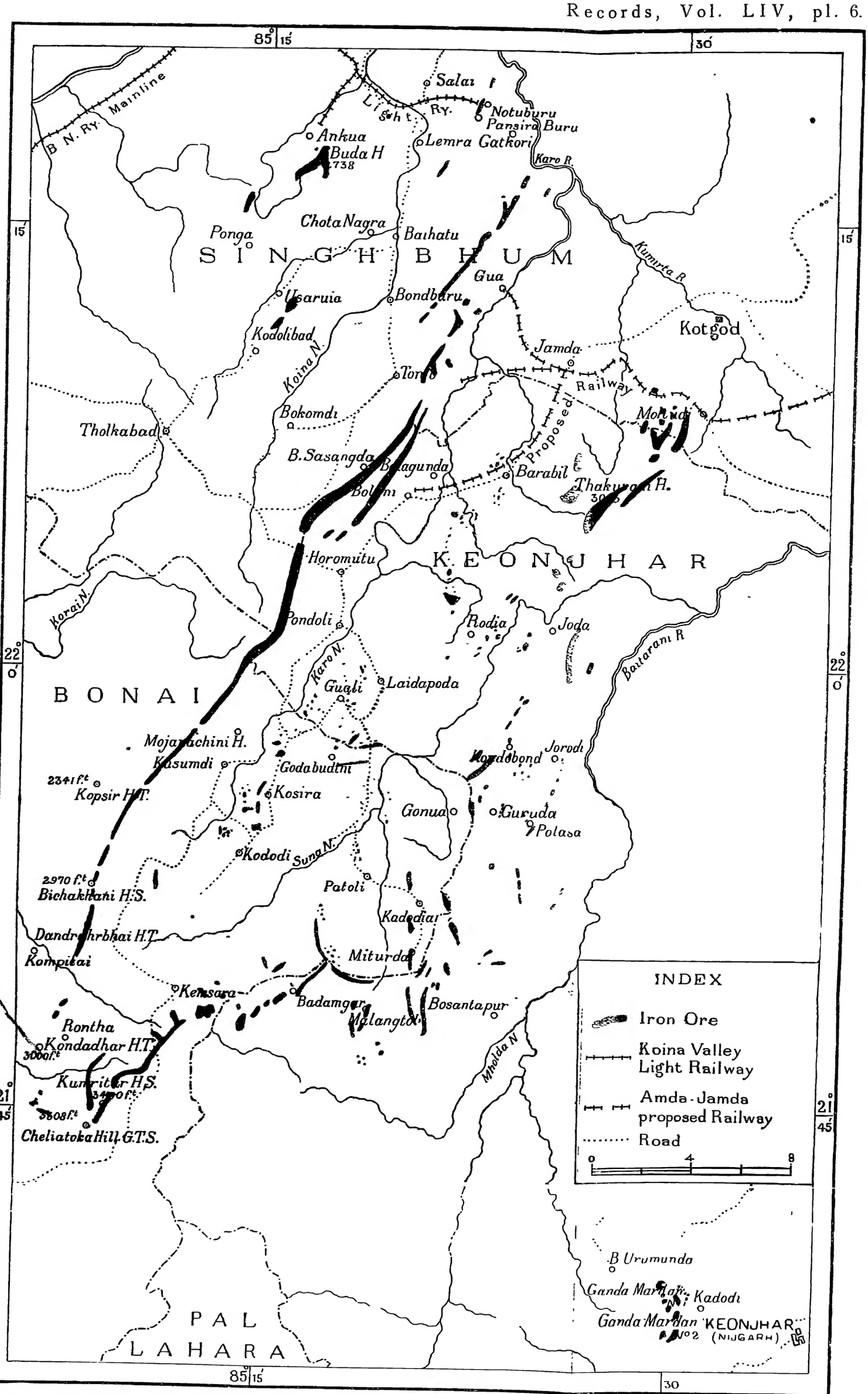
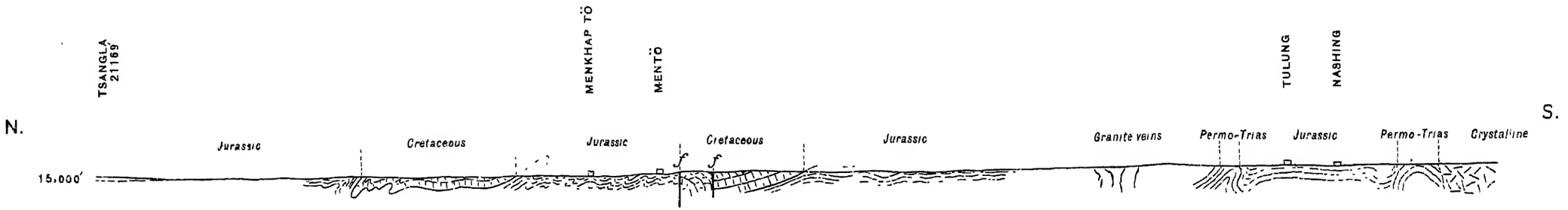


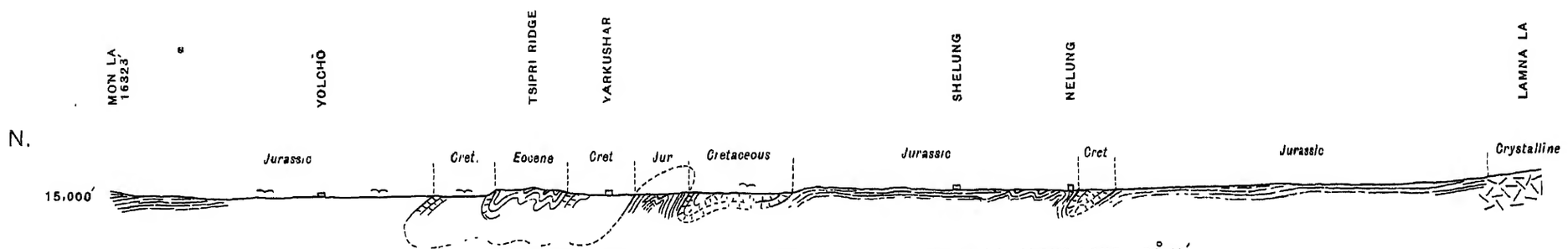
Topography from sheets No. 73 G and F. . Scale of 1 inch = 4 miles.

Col ptd. G. S. I. Calcutta

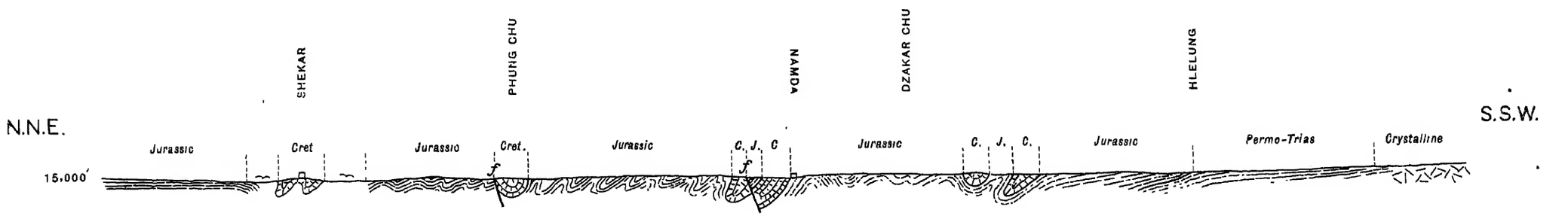
MAP OF THE IRON-ORE AREA OF SINGBHUM & ORISSA



DIAGRAMMATIC SECTION THROUGH TSANGLA, MENTO AND TULUNG, ALONG LONG. 86° 8'.



DIAGRAMMATIC SECTION FROM THE MON LA TO THE LAMNA LA, ALONG LONG. 86° 42'.



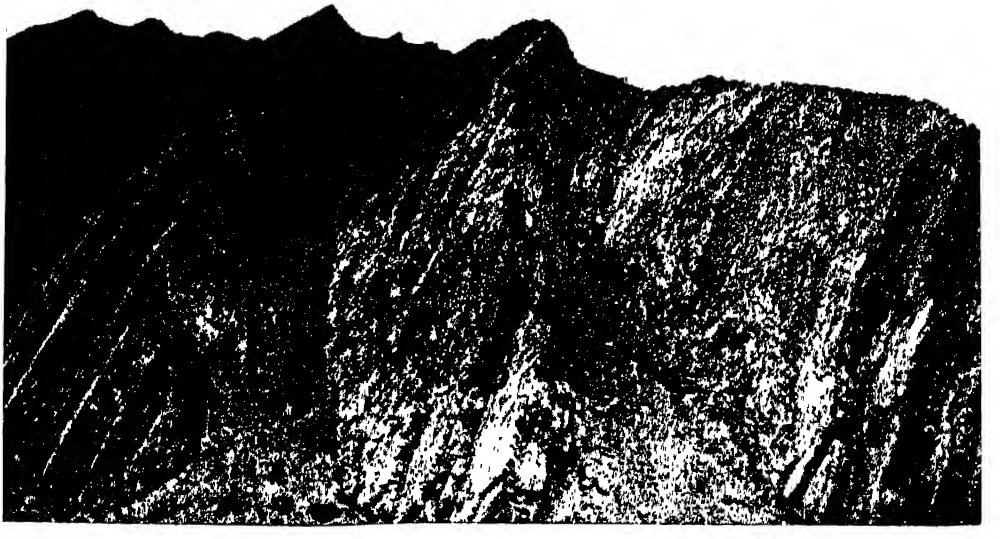
DIAGRAMMATIC SECTION THROUGH SHEKAR, NAMDA AND HLELUNG.

Thicknesses of formations shown have no exact significance.

Scale of sections 4 miles to 1 inch.

Litho G. S. I Calcutta.

FIG. 1. ALLUVIAL GRAVEL TERRACES AND HILLS OF JURASSIC SHALES, KYISHONG, PHUNG CHU VALLEY.



A. M. Heron, Photos.

FIG 1. FOLDED JURASSIC SHALES, NEAR MEN TO.

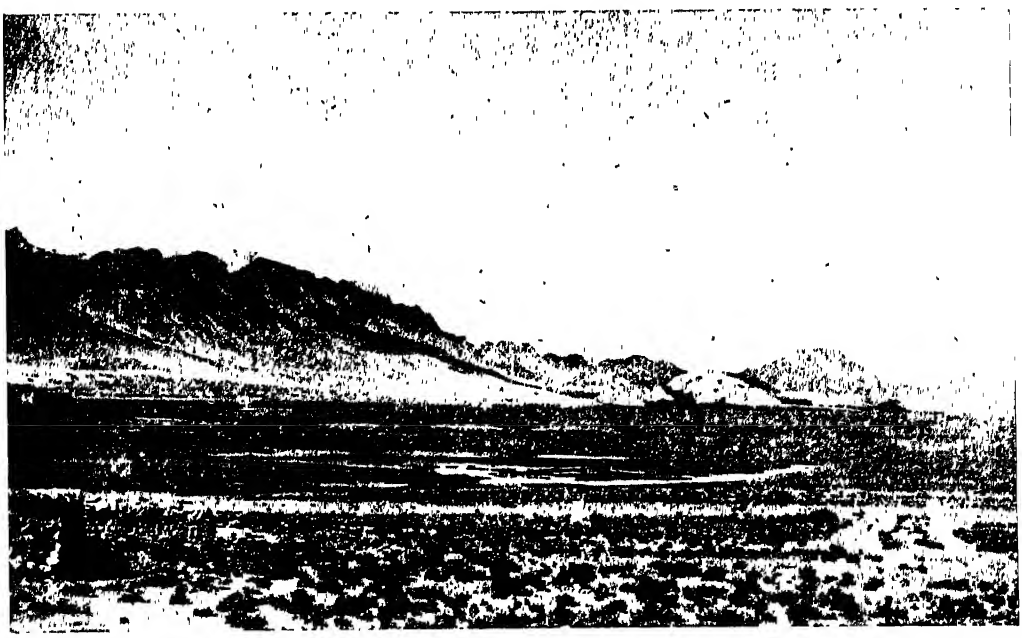


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FIG. 2 GENERAL VIEW OF PHUNG CHU VALLEY, FROM MEMO LOOKING EAST, TSIFRI RIDGE ON LEFT

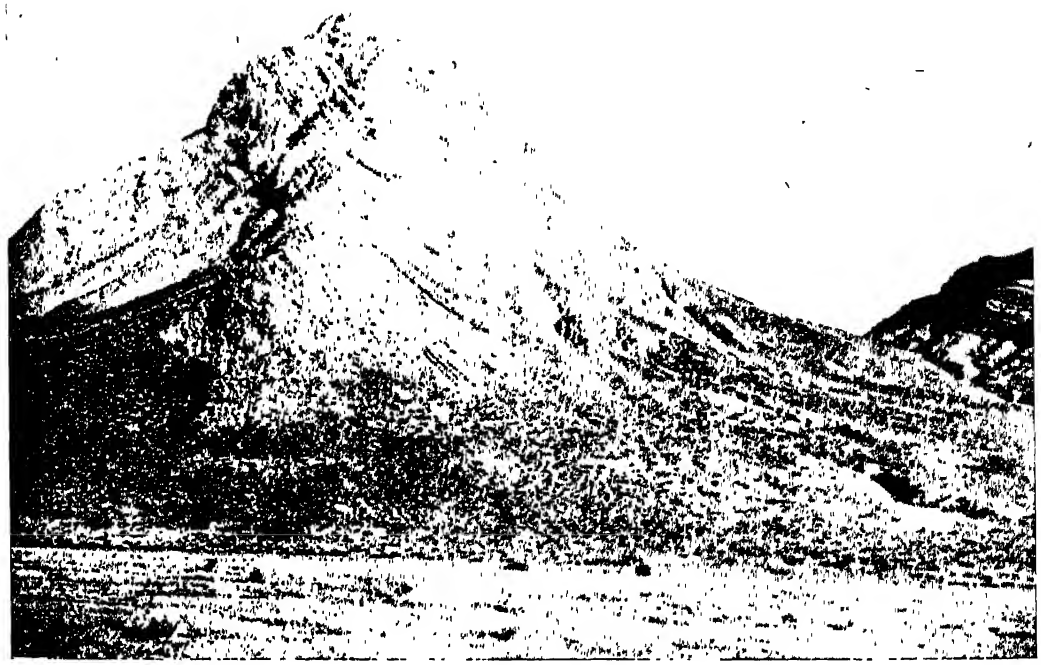

FIG. 1. SYNCLINAL HILL OF CRETACEOUS LIMESTONE, MEMO, PHUNG CHU VALLEY.

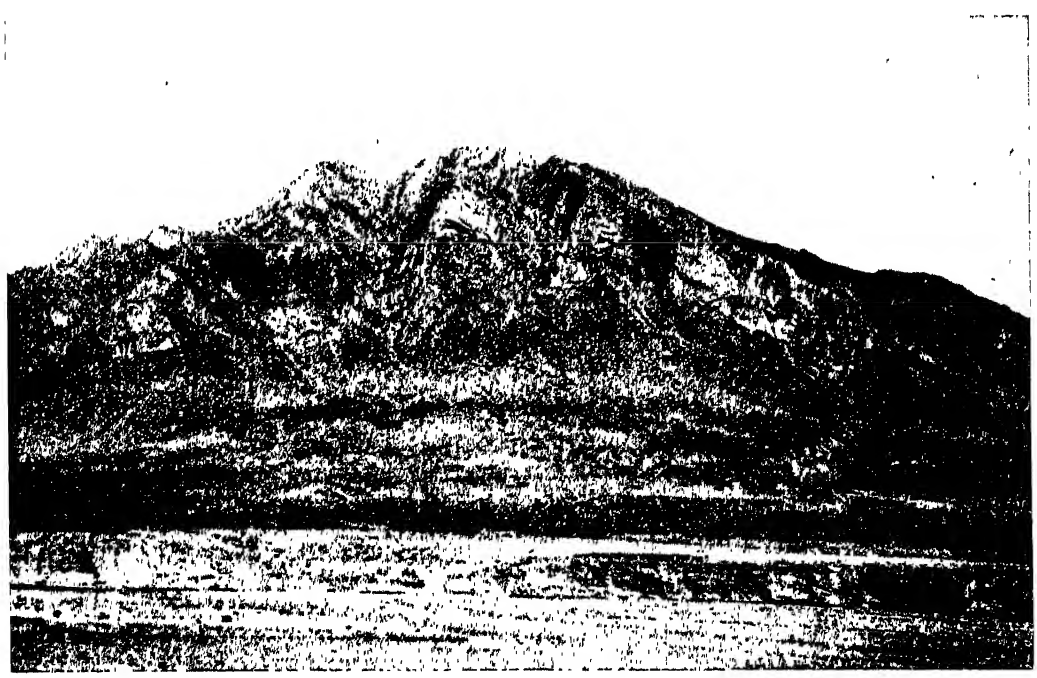

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FIG. 2. EASTERN END OF TSIPRI RIDGE, SHOWING FOLDED CRETACEOUS LIMESTONES.

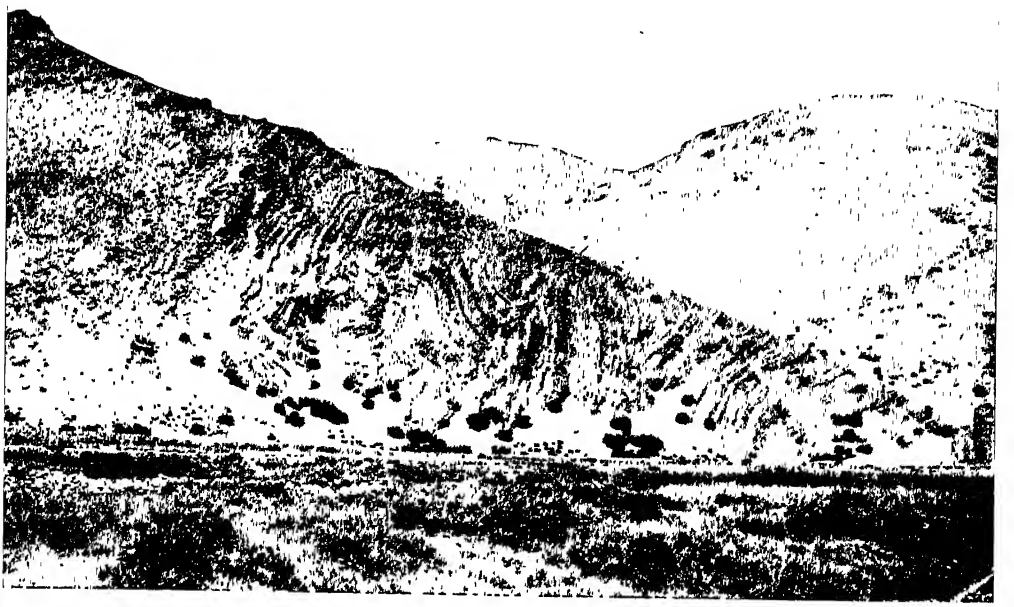

FIG. 1. FOLDED CRETACEOUS LIMESTONES, PALDING, NEAR DZAKAR CHU.

A. M. Heron, Photo. *G. S. I. Calcutta*

FIG 2 FOLDED CRETACEOUS LIMESTONES RIPHE NEAR DZAKAR CHU

and danatite from Khetri mines, Rajputana; with remarks on Jaipurite (Syepoorite). Zinc-ore (Smithsonite and Blende) with barytes in Karnul district, Madras. Mud eruption in island of Cheduba.

Part 3.—Artesian borings in India. Oligoclase granite at Wangtu on Sutlej, North-West Himalayas. Fish-plate from Siwaliks. Palæontological notes from Hazaribagh and Lohardagga districts. Fossil carnivora from Siwalik hills.

Part 4 (out of print).—Unification of geological nomenclature and cartography. Geology of Arvali region, central and eastern. Native antimony obtained at Pulo Obin, near Singapore. Turgite from Juggiapett, Kistnah District, and zinc carbonate from Karnul, Madras. Section from Dalhousie to Pangi, *viâ* Sach Pass. South Rewah Gondwana basin. Submerged forest on Bombay Island.

Vol. XV, 1882.

Part 1 (out of print).—Annual report for 1881. Geology of North-West Kashmir and Khagan. Gondwana labyrinthodonts (Siwalik and Jamna mammals). Geology of Dalhousie, North-West Himalaya. Palm leaves from (tertiary) Murree and Kasauli beds in India. Iridosmine from Noa-Dihing river, Upper Assam, and Platinum from Chutia Nagpur. On (1) copper mine near Yongri hill, Darjiling district; (2) arsenical pyrites in same neighbourhood; (3) kaolin at Darjiling. Analyses of coal and fire-clay from Makum coal-field, Upper Assam. Experiments on coal of Pind Dadun Khan, Salt-range, with reference to production of gas, made April 29th, 1881. International Congress of Bologna.

Part 2 (out of print).—Geology of Travancore State. Warkilli beds and reported associated deposits at Quilon, in Travancore. Siwalik and Narbada fossils. Coal-bearing rocks of Upper Rer and Mand rivers in Western Chutia Nagpur. Pench river coal-field in Chhindwara district, Central Provinces. Boring for coal at Engsein, British Burma. Sapphires in North-Western Himalaya. Eruption of mud volcanoes in Cheduba.

Part 3 (out of print).—Coal of Mach (Much) in Bolan Pass, and of Sharigh on Harnai route between Sibi and Quetta. Crystals of stilbite from Western Ghats, Bombay. Traps of Darang and Mandi in North-Western Himalayas. Connexion between Hazara and Kashmir series. Umaria coal-field (South Rewah Gondwana basin). Daranggiri coal-field, Garo Hills, Assam. Coal in Myanoung division, Henzada district.

Part 4 (out of print).—Coal-fields of Mysore. Borings for coal at Beddadanol, Godavari district, in 1874. Supposed occurrence of coal on Kistna.

Vol. XVI, 1883.

Part 1.—Annual report for 1882. Richthofenia. Kays (Anomia Lawrenciana, Koninck). Geology of South Travancore. Geology of Chamba. Basalts of Bombay.

Part 2 (out of print).—Synopsis of fossil vertebrata of India. Bijori Labyrinthodont. Skull of Hippotherium antilopinum. Iron ores, and subsidiary materials for manufacture of iron, in north-eastern part of Jabalpur district. Laterite and other manganese-ore occurring at Gosulpore, Jabalpur district. Umaria coal-field.

Part 3 (out of print).—Microscope structure of some Dalhousie rocks. Lavas of Aden. Probable occurrence of Siwalik strata in China and Japan. Mastodon angustidens in India. Traverse between Almora and Mussooree. Cretaceous coal-measures at Borsora, in Khasia Hills, near Laour, in Sylhet.

Part 4.—Palæontological notes from Daltonganj and Hutar coal-fields in Chota Nagpur. Altered basalts of Dalhousie region in North-Western Himalayas. Microscopic structure of some Sub-Himalayan rocks of tertiary age. Geology of Jaunsar and Lower Himalayas. Traverse through Eastern Khasia, Jaintia, and North Cachar Hills. Native lead from Maulmain and chromite from the Andaman Islands. Fiery eruption from one of the mud volcanoes of Cheduba Island, Arakan. Irrigation from wells in North-Western Provinces and Oudh.

Vol. XVII, 1884.

Part 1.—Annual report for 1883. Smooth-water anchorages or mud-banks of Narrakal and Alleppy on Travancore coast. Billa Surgam and other caves in Kurnool district. Geology of Chaunri and Sihunta parganas of Chamba. Lyttonia, Waagen, in Kaling series of Kashmir.

Part 2.—Earthquake of 31st December 1881. Microscopic structure of some Himalayan granites and gneissose granites. Coal exploration. Re-discovery of fossils in Siwalik beds. Mineral resources of Andaman Islands in neighbourhood of Port Blair. Intertrappean beds in Deccan and Lavaroo group in Western North America.

Part 3 (out of print).—Microscope structure of some Aryali rocks. Section along Indus from Peshawar Valley to Salt-range. Sites for boring in Raigarh-Hingir coal-field (first notice). Minute near Rajhara, Central Provinces. Turquoise mines of Nishapur, Khorassan. Fiery eruption from Mud-volcano of Cheduba Island, Arakan. Langrin coal-field, South Western Khasia Hills. Umaria coal-field.

Part 4 (out of print).—Geology of part of Gangasulan pargana of British Garhwal. Slates and schists imbedded in gneissose granite of North-West Himalayas. Geology of Takht-i-Suleiman. Smooth-water anchorages of Travancore coast. Auriferous sands of the Subansiri river, Pondicherry lignite, and phosphatic rocks at Musuri. Billa Surgam caves.

Vol. XVIII, 1885.

Part 1.—Annual report for 1884. Country between Singareni coal-field and Kistna river. Geological sketch of country between Singareni coal-field and Hyderabad. Coal and limestone in Doigrung river near Golaghat, Assam. Homotaxis, as illustrated from Indian formations. Afghan field notes.

Part 2.—Fossiliferous series in Lower Himalaya, Garhwal. Age of Mandhali series in Lower Himalaya. Siwalik camel (Camelus Antiquus, nobis ex Falc. and Caut. MS.). Geology of Chamba. Probability of obtaining water by means of artesian wells in plains of Upper India. Artesian sources in plains of Upper India. Geology of Aka Hills. Alleged tendency of Arakan mud volcanoes to burst into eruption most frequently during rains. Analyses of phosphatic nodules and rock from Mussooree.

Part 3 (out of print).—Geology of Andaman Islands. Third species of Merycopotamus. Percolation as affected by current. Pithalla and Chandpur meteorites. Oil-wells and coal in Thayetmyo District, British Burma. Antimony deposits in Maulmain district. Kashmir earthquake of 30th May 1885. Bengal earthquake of 14th July 1885.

Part 4 (out of print).—Geological work in Chhattisgarh division of Central Provinces. Bengal earthquake of 14th July 1885. Kashmir earthquake of 30th May 1885. Excavations in Billa Surgam caves. Nepaulite. Sabetmahet meteorite.

Vol. XIX, 1886.

Part 1.—Annual report for 1885. International Geological Congress of Berlin. Palæozoic Fossils in Olive group of Salt-range. Correlation of Indian and Australian coal-bearing beds. Afghan and Persian Field-notes. Section from Simla to Wangtu, and petrological character of Amphibolites and Quartz Diorites of Sutlej valley.

Part 2 (out of print).—Geology of parts of Bellary and Anantapur districts. Geology of Upper Dehing basin in Singpho Hills. Microscopic characters of eruptive rocks from Central Himalayas. Mammalia of Karnul Caves. Prospects of finding coal in Western Rajputana. Olive group of Salt-range. Boulder-beds of Salt-range. Gondwana Homotaxis.

Part 3 (out of print).—Geological sketch of Vizagapatam district, Madras. Geology of Northern Jesalmer. Microscopic structure of Malani rocks of Arvali region. Malanjkhandi copper-ore in Balaghat district, C. P.

Part 4 (out of print).—Petroleum in India. Petroleum exploration at Khátan. Boring in Chhattisgarh coal-fields. Field-notes from Afghanistan: No. 3, Turkistan. Fiery eruption from one of mud volcanoes of Cheduba Island, Arakan. Nammianthal aerolite. Analysis of gold dust from Meza valley, Upper Burma.

Vol. XX, 1887.

Part 1 (out of print).—Annual report for 1886. Field-notes from Afghanistan: No. 4, from Turkistan to India. Physical geology of West British Garhwal; with notes on a route traversed through Jaunsar-Bawar and Tiri-Garhwal. Geology of Garo Hills. Indian image-stones. Soundings recently taken off Barren Island and Narcondam. Talchir boulder-beds. Analysis of Phosphatic Nodules from Salt-range, Punjab.

Part 2.—Fossil vertebrata of India. Echinoidea of cretaceous series of Lower Narbada Valley. Field-notes: No. 5—to accompany geological sketch map of Afghanistan and North-Eastern Khorassan. Microscopic structure of Rajmahal and Deccan traps. Dolerite of Chor. Identity of Olive series in east with speckled sandstone in west of Salt-range in Punjab.

Part 3.—Retirement of Mr. Medlicott. J. B. Mushketoc's Geology of Russian Turkistan. Crystalline and metamorphic rocks of Lower Himalaya, Garhwal, and Kumaun, Section I. Geology of Simla and Jutogh. 'Lalipur' meteorite.

Part 4 (out of print).—Points in Himalayan geology. Crystalline and metamorphic rocks of Lower Himalaya, Garhwal, and Kumaon, Section II. Iron industry of western portion of Raipur. Notes on Upper Burma. Boring exploration in Chhattisgarh coal-fields (Second notice). Pressure Metamorphism, with reference to foliation of Himalayan Gneissose Granite. Papers on Himalayan Geology and Microscopic Petrology.

Vol. XXI, 1888.

Part 1 (out of print).—Annual report for 1887. Crystalline and metamorphic rocks of Lower Himalaya, Garhwal, and Kumaun, Section III. Birds'-nest of Elephant Island, Mergui Archipelago. Exploration of Jesalmer, with a view to discovery of coal. Facetted pebble from boulder bed ('speckled sandstone') of Mount Chel in Salt-range, Punjab. Nodular stones obtained off Colombo.

Part 2.—Award of Wollaston Gold Medal, Geological Society of London, 1888. Dharwar System in South India. Igneous rocks of Raipur and Balaghat, Central Provinces. Sangar Marg and Mohowgale coal-fields, Kashmir.

Part 3 (out of print).—Manganese Iron and Manganese Ores of Jabalpur. 'The Carboniferous Glacial Period.' Pre-tertiary sedimentary formation of Simla region of Lower Himalayas.

Part 4.—Indian fossil vertebrates. Geology of North-West Himalayas. Blown-sand rock sculpture. Nummulites in Zanskar. Mica traps from Barakar and Raniganj.

Vol. XXII, 1889.

Part 1 (out of print).—Annual report for 1888. Dharwar System in South India. Wajra Karur diamonds, and M. Chaper's alleged discovery of diamonds in pegmatite. Generic position of so-called Plesiosaurus Indicus. Flexible sandstone or Itacolumite, its nature, mode of occurrence in India, and cause of its flexibility. Siwalik and Narbada Chelonia.

Part 2 (out of print).—Indian Steatite. Distorted pebbles in Siwalik conglomerate, "Carboniferous Glacial Period." Notes on Dr. W. Waagen's "Carboniferous Glacial Period." Oil-fields of Twingoung and Beme, Burma. Gypsum of Nehal Nadi, Kumaun. Materials for pottery in neighbourhood of Jabalpur and Umaria.

Part 3.—Coal outcrops in Sharigh Valley, Baluchistan. Trilobites in Neobolus beds of Salt-range. Geological notes. Cherra Poonjee coal-field, in Khasia Hills. Cobaltiferous Matt from Nepál. President of Geological Society of London on International Geological Congress of 1888. Tin-mining in Mergui district.

Part 4 (out of print).—Land-tortoises of Siwaliks. Pelvis of a ruminant from Siwaliks. Assays from Sambhar Salt-Lake in Rajputana. Manganiferous iron and Manganese Ores of Jabalpur. Palagonite-bearing traps of Rájmahál hills and Deccan. Tin-smelting in Malay Peninsula. Provisional Index of Local Distribution of Important Minerals, Miscellaneous Minerals, Gem Stones and Quarry Stones in Indian Empire: Part 1.

Vol. XXIII, 1890.

Part 1.—Annual report for 1889. Lakadong coal-field, Jaintia Hills. Pectoral and pelvic girdles and skull of Indian Dicynodonts. Vertebrate remains from Nagpur district (with description of fish-skull). Crystalline and metamorphic rocks of Lower Himalayas, Garhwál and Kumaon, Section IV. Bivalves of Olive-group, Salt-range. Mud-banks of Travancore coasts.

Part 2 (out of print).—Petroleum explorations in Harnai district, Baluchistan. Sapphire Mine of Kashmir. Supposed Matrix of Diamond at Wajra Karur, Madras. Sonapet Gold-field. Field notes from Shan Hills (Upper Burma). New species of Syringosphæridæ.

Part 3 (out of print).—Geology and Economic Resources of Country adjoining Sind-Pishin Railway between Sharigh and Spintangi, and of country between it and Khatan. Journey through India in 1888-89, by Dr. Johannes Walther. Coal-fields of Lairungao, Maosandram, and Mao-be-lar-kar, in the Khasi Hills. Indian Steatite. Provisional Index of Local Distribution of Important Minerals, Miscellaneous Minerals, Gem Stones, and Quarry Stones in Indian Empire.

Part 4 (out of print).—Geological sketch of Naini Tal; with remarks on natural conditions governing mountain slopes. Fossil Indian Bird Bones. Darjiling Coal between Lisu and Ramthi rivers. Basic Eruptive Rocks of Kadapah Area. Deep Boring at Lucknow. Coal Seam of Dore Ravine, Hazara.

Vol. XXIV, 1891.

Part 1 (out of print).—Annual report for 1890. Geology of Salt-range of Punjab, with re-considered theory of Origin and Age of Salt-Marl. Graphite in decomposed Gneiss (Laterite) in Ceylon. Glaciers of Kabru, Pándim, etc. Salts of Sambhar Lake in Rajputana, and 'Reh' from Aligarh in North-Western Provinces. Analysis of Dolomite from Salt-range, Punjab.

Part 2 (out of print).—Oil near Moghal Kot, in Sherání country, Suleiman Hills. Mineral Oil from Suleiman Hills. Geology of Lushai Hills. Coal-fields in Northern Shan States. Reported Namséka Ruby-Mine in Mainglôn State. Tourmaline (Schorl) Mines in Mainglôn State. Salt-spring near Bawgyo, Thibaw State.

Part 3 (out of print).—Boring in Daltongunj Coal-field, Palamow. Death of Dr. P. Martin Duncan. Pyroxenic varieties of Gneiss and Scapolite-bearing Rocks.

Part 4 (out of print).—Mammalian Bones from Mongolia. Darjiling Coal Exploration. Geology and Mineral Resources of Sikkim. Rocks from the Salt-range, Punjab.

Vol. XXV, 1892.

Part 1.—Annual report for 1891. Geology of Thal Chotiali and part of Mari country. Petrological Notes on Boulder-bed of Salt-range, Punjab. Sub-recent and Recent Deposits of valley plains of Quetta, Pishin, and Dasht-i-Bedaulat; with appendices on Chemistry of Quetta and Artesian water-supply of Quetta and Pishin.

Part 2 (*out of print*).—Geology of Safed Koh. Jherria Coal-field.
Part 3 (*out of print*).—Locality of Indian Tschoffkinite. Geological Sketch of country north of Bhamo. Economic resources of Amber and Jade mines area in Upper Burma. Iron-ores and Iron industries of Salem District. Riebeckite in India. Coal on Great Tenasserim River, Lower Burma.
Part 4.—Oil Springs at Mogal Kot in Shirani Hills. Mineral Oil from Suleiman Hills. New Amber-like Resin in Burma. Triassic Deposits of Salt-range.

VOL. XXVI, 1893.

Part 1 (*out of print*).—Annual report for 1892. Central Himalayas. Jadeite in Upper Burma. Burmite, new Fossil Resin from Upper Burma. Prospecting Operations, Mergui District, 1891-92.
Part 2.—Earthquake in Baluchistan of 20th December 1892. Burmite, new amber-like fossils from Upper Burma. Alluvial deposits and Subterranean water-supply of Rangoon.
Part 3.—Geology of Sherani Hills. Carboniferous Fossils from Tenasserim. Boring at Chandernagore. Granite in Tavoy and Mergui.
Part 4 (*out of print*).—Geology of country between Chappar Rift and Harnai in Baluchistan. Geology of part of Tenasserim Valley with special reference to Tendau-Kamapying Coal-field. Magnetite containing Manganese and Alumina. Hislopite.

VOL. XXVII, 1894.

Part 1.—Annual report for 1893. Bhaganwala Coal-field, Salt-range, Punjab.
Part 2 (*out of print*).—Petroleum from Burma. Singareni Coal-field, Hyderabad (Deccan). Gohna Landslip, Garhwal.
Part 3 (*out of print*).—Cambrian Formation of Eastern Salt-range. Giridih (Karharbari) Coal-fields. Chipped (?) Flints in Upper Miocene of Burma. Velates Schmideliana, Chemn., and Provelates grandis, Sow. sp., in Tertiary Formation of India and Burma.
Part 4 (*out of print*).—Geology of Wuntho in Upper Burma. Echinoids from Upper Cretaceous System of Baluchistán. Highly Phosphatic Mica Peridotites intrusive in Lower Gondwana Rocks of Bengal. Mica-Hypersthene-Hornblende-Peridotite in Bengal.

VOL. XXVIII, 1895.

Part 1.—Annual report for 1894. Cretaceous Formation of Pondicherry. Early allusion to Barren Island. Bibliography of Barren Island and Narcondam from 1884 to 1894.
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